SMALL PUBLIC WATER SYSTEM

OPERATOR'S GUIDE

DIVISION OF WATER SUPPLY
TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

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FOREWORD

This manual has been written for those who maintain a small Community (CWS) or Non-Community Public Water System (NCWS) in Tennessee. The public trusts you to provide safe drinking water. To fulfill that trust, each water supplier must constantly be aware of possible sources of contamination and guard against them.

This manual discusses the requirements for sampling, testing, and record keeping required by state law and regulations. At the end of the manual (Appendix D) is a list of people in state government who stand ready to help you. Give someone in the Division of Water Supply a call if you have a question. The Environmental Assistance Centers (EAC) can be reached through the department's toll free number 1-888-891-8332.

Jackson EAC
362 Carriage House Dr.
Jackson TN 38305
731-512-1300

Nashville EAC
711 R.S. Gass Blvd.
Nashville, TN 37243
615-687-7000

Cookeville EAC
1221 South Willow Ave.
Cookeville TN 38506
931-432-4015

Knoxville EAC
Suite 220 State Plaza
2700 Middlebrook Pike
Knoxville TN 37921
865-594-6035

Johnson City EAC
2305 Silverdale Road
Johnson City TN 37601
423-854-5400

Columbia EAC
2484 Park Plus Drive
Columbia TN 38401
931-380-3371

Chattanooga EAC
540 McCallie Avenue
Suite 550-State Office Bldg.
Chattanooga TN 37401
423-634-5745

Fleming Training Center
2022 Blanton Drive
Murfreesboro TN 37129
615-898-8090

Visit the division's web site http://www.state.tn.us/environment/dws for additional information.

This publication was prepared by the staff of the Division of Water Supply. It describes requirements and guidelines that were in effect as of July 2003.

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DO YOU OPERATE A PUBLIC WATER SYSTEM?

You operate a public water system (PWS) when your water system provides water for human consumption and has 15 or more service connections OR when your water system provides water regularly for 25 or more persons at least 60 days out of the year. Human consumption includes drinking, hand washing, bathing, cooking, and food preparation. Public water systems are classified either as community, non-transient non-community, or transient non-community.

Your public water system (PWS) is classified as a non-community water system if the people who use the water are transients or occasional users. Non-Community Water Systems are further defined as either transient non-community water systems or non-transient non-community water systems.

Let's take some examples. A rural church has its own well with an electric pump, tank, and pipes going to a drinking fountain and restroom in the church building. Services are held each Sunday and on 4 other days each year. The church does not hold VBS or weeklong revivals. Because this church provides water only 56 days a year, it is NOT a public water system. On the other hand, if this church had services on both Sunday and Wednesday and made water available to an average of at least 25 people each time, then the church does maintain a public water system (PWS) since water is made available to 25 persons 60 or more days each year. It is a transient non-community water system because the people using the water are occasional users.

Here's another example. A rural store has a lunch counter. It has its own well and water system. The store uses water for its luncheon customers, food preparation and cleanup, restroom facilities and typically serves 30-35 customers per day. The store is a transient non-community public water system (TNCWS) as it serves 25 or more people at least 60 days each year. These people use the water only at the time they are at the store. They are occasional users.

Another classification of a non-community water system is called a non-transient non-community water system (NTNCWS). A non-transient non-community water system or NTNCWS means a non-community water system that regularly serves at least 25 of the same people over 6 months of the year. Examples of a NTNCWS would be a factory on a well that serves water to 25 or more employees, a school on a well with 25 or more students, or a day care center on a well with 25 or more children and staff.

This is the final example. A trailer park has its own water system with space for 20 trailers. The park is used year round, with most of the families connecting their trailers to the water system. This is a public water system (PWS) since it has 15 or more service connections. It is also a community water system (CWS) since the people using this system are considered year-round residents.

This manual is for people who own or operate either a community public water system or a non-community public water system mentioned above. If you operate or own one of these, please

read the rest of this manual carefully. It tells you what you are required to do under Tennessee law.

MOST PUBLIC WATER SYSTEMS NEED A CERTIFIED OPERATOR

WATER ENVIRONMENTAL HEALTH ACT

The Tennessee General Assembly revised the "Water Environmental Health Act" effective May 25, 1984. All public water systems which have 15 or more service connections or regularly has water available to at least 25 individuals for either 60 consecutive days or for a total of 120 days in any one-year must have a certified operator. Some systems are required to have both a certified plant operator and a certified distribution system operator. Most public water systems require a certified operator. Systems which are not open for 60 consecutive days or a total of 120 days a year may not be required to have a certified operator

Tennessee operator certification rules classify water treatment plants and distribution systems according to their complexity and size. Certification for the more complex plants requires more technical knowledge and experience on the part of the operator than does certification for someone operating a well that serves a small system. The complexity of the operator certification tests varies according to the type system operated.

Periodic training courses and home study materials can be obtained through the Fleming Training Center (FTC) in Murfreesboro. Persons desiring to become certified must complete and file an application with the Operator Certification Board, pay an examination fee, and pass a written examination. Annual renewal fees and continuing education are required to renew an operator certificate.

A certified operator can operate more than one public water system provided the systems are located so that the operator can reasonably travel between the two systems. Many small water system owners find it convenient to hire a certified operator on a part-time basis to supervise the operation of the small water system. A list of currently certified operators in a particular county may be obtained from the Division of Water Supply's Central Office or Environmental Assistance Center (EAC) or from the Fleming Training Center in Murfreesboro (615-898-8090).

The Commissioner of the Department of Environment and Conservation (TDEC) may revoke certification and ask for civil penalties against an operator if the operator does not exercise reasonable care in the operation of a water system or reports false or inaccurate data to the state.

Operator classifications parallel water plant classifications and are as follows:

> **Small Water System:** This classification applies to water systems which use a well or spring not under the direct influence of surface water (defined later) and serves less than

fifty (50) service connections. This classification also applies to systems that purchase water for resale and serve less than fifty (50) service connections. This classification serves as the distribution system certification for small water systems. Generally, this classification will still apply if the system chlorinates or disinfects the water.

Water Treatment Grade I: This classification applies to persons that operate a groundwater water system that has limited treatment process. Treatment will generally consist of only disinfection and/or corrosion control. A Water Treatment Grade I Operator Certificate would be required to operate any system with more than fifty (50) service connections with limited treatment.

Water Treatment Grade II through IV: These classifications apply to the larger more complex water systems that filter, soften, or otherwise chemically alter the water.

Distribution I System: This classification is for a water distribution system that serves at least fifty service connections, but no more than five thousand service connections.

Distribution II System: This class is for operators of water distribution systems serving more than 5,000 connections.

Water systems that have a treatment system and serve 50 or more service connections are required to have both a certified plant operator and a certified distribution system operator.

Any operator holding one of the above listed certifications may serve as the certified operator of a small water system.

THE NEED FOR SAFE DRINKING WATER

People are becoming more concerned about drinking water. Travelers to a foreign country often find out to their sorrow that the water caused stomach or intestinal upset. Although not so common in Tennessee, water has been the cause of stomach upset and can possibly be the source of long term health problems, too. Most of those who provide water to the public want to provide safe water. Most problems with drinking water do not come from a lack of desire by the provider; they are caused by lack of knowledge of what's needed to provide safe drinking water.

PUBLIC WATER SUPPLY IDENTIFICATION NUMBER (PWSID)

The State assigns each public water system (PWS) a public water supply identification number (PWSID). When your system has been identified as a public water system and a designated representative of your system has been named, the state will assign a PWSID number to your system.

The PWSID number is important. Your PWSID number should be used on all bacteriological samples, reports and correspondence submitted to state offices, and whenever you call state offices, be prepared to state your number. All information concerning your public water system is entered into the state's computer file and is identified by the PWSID number. Your record of compliance with state law depends on your making sure your PWSID is recorded on each monitoring report.

MONITORING AND TESTING REQUIRED

A Public Water System's requirements for monitoring and testing depend on the source of water, the population served, and the treatment techniques employed. Chemical and microbiological sampling requirement are as follows:

SAMPLING AND TESTING FOR BACTERIA

Reason for Test: Many of the diseases that people contract are caused by bacteria and viruses. Bacteria are tiny living organisms that can only be seen through a microscope. These organisms exist almost everywhere and untreated water may contain disease-producing bacteria. Therefore, Tennessee requires that each public water system have a microbiological test of its water on a prescribed schedule. Surface water from creeks, ponds, lakes and rivers always contain coliform bacteria. Many wells and springs will also contain coliform bacteria.

State sends out sample bottles: Bacteriological sample bottles will be sent to you from the nearest state laboratory if you are registered with the state as a public water system. If you fail to receive a bottle according to the schedule assigned to your system, please call the laboratory or Environmental Assistance Center (EAC) immediately and request your bottle. It is the water supplier's or owner's responsibility to insure that bottles are obtained, samples collected, and samples delivered to the laboratory on time. A Water Bacteriological Analysis form comes with each sample bottle (see Figure 1). This is a 4-copy form with carbons between each sheet.

Taking the water sample for bacteriological testing: The procedure for obtaining a water sample from your system is very important. If you fail to take the sample properly it can produce false results when the laboratory analyzes the sample. The directions for taking a sample are printed on the reverse side of the sample form. Here are the main things to be careful about when you take a sample:

1. The sample bottle you receive from the state laboratory has been sterilized and contains a small amount of a necessary chemical. These empty bottles should be kept in a secure location so that no one can tamper with them. Handle the bottle with care so you do not contaminate it – particularly after you have unscrewed the cap. DO NOT rinse out the chemical already in the bottle. This chemical is sodium thiosulfate and neutralizes any chlorine present in the water sample.

2. Find out the dispatch schedule of first class mail from the post office where you will mail the sample to the state laboratory. You will want to use a post office that ships the sample directly to the city where the laboratory is located. You may have to pay for overnight delivery to insure the sample gets to the laboratory within the specified time period. Arrange to take your water sample at a time of day just prior to the mail dispatch time. You want the sample to reach the laboratory in as short a time as possible after you have taken it, but in no case should it reach the laboratory more than 30 hours after being collected. Take the sample on Monday, Tuesday, or Wednesday of the week. If possible, take the sample early in the compliance period. Avoid taking it a day or two before a state government holiday if you are using the State laboratory. Always use first class overnight mail. Do not mail it certified or registered, as this will cause delays. You may need to consider shipping the sample by overnight mail services (1-day delivery) or hand delivering the sample to the laboratory. It is the water supplier's responsibility to insure bacteriological samples reach the laboratory within 30 hours of collection and before the compliance period ends.

3. When obtaining the sample from a faucet, avoid swing faucets. If the faucet has an aerator, remove it first. Let the water run from the faucet for about 3 minutes. Check the chlorine residual if you disinfect with chlorine. If the sample is from a pump, operate pump for several minutes until all holding tanks are flushed. Avoid outside faucets and drinking fountains if possible. If not possible make sure a drinking fountain is clean.

4. Be particularly careful when you obtain a water sample so you don't accidentally contaminate it or the sample bottle. Take the following steps when taking your water sample:

    a. Inspect the faucet carefully for leaks around the valve stem. Leaks around the valve stem may allow water to run down the outside of the faucet and into the sample. This could cause contamination of the sample.

    b. Make sure that water splatter does not occur and bounce back onto the outside of the faucet.

    c. Check the sample bottle. Do not ever use a bottle that has had the cap removed or has a loose cap.

    d. Adjust the flow of water from the faucet so that a slow steady stream is created.

    e. Unscrew the bottle cap and remove it. Be careful that you don't touch the inside of the bottle cap or allow it to come in contact with anything. Do not lay the bottle cap down so that its rim touches anything. If you accidentally touch the inside of the bottle or bottle cap, discard the bottle and obtain another sterile sample bottle before collecting the sample.

    f. Tilt the bottle slightly and place it into the stream of water. Fill to shoulder of the bottle.

g. Replace bottle cap tightly. Shake bottle and turn upside down to check for leaks.

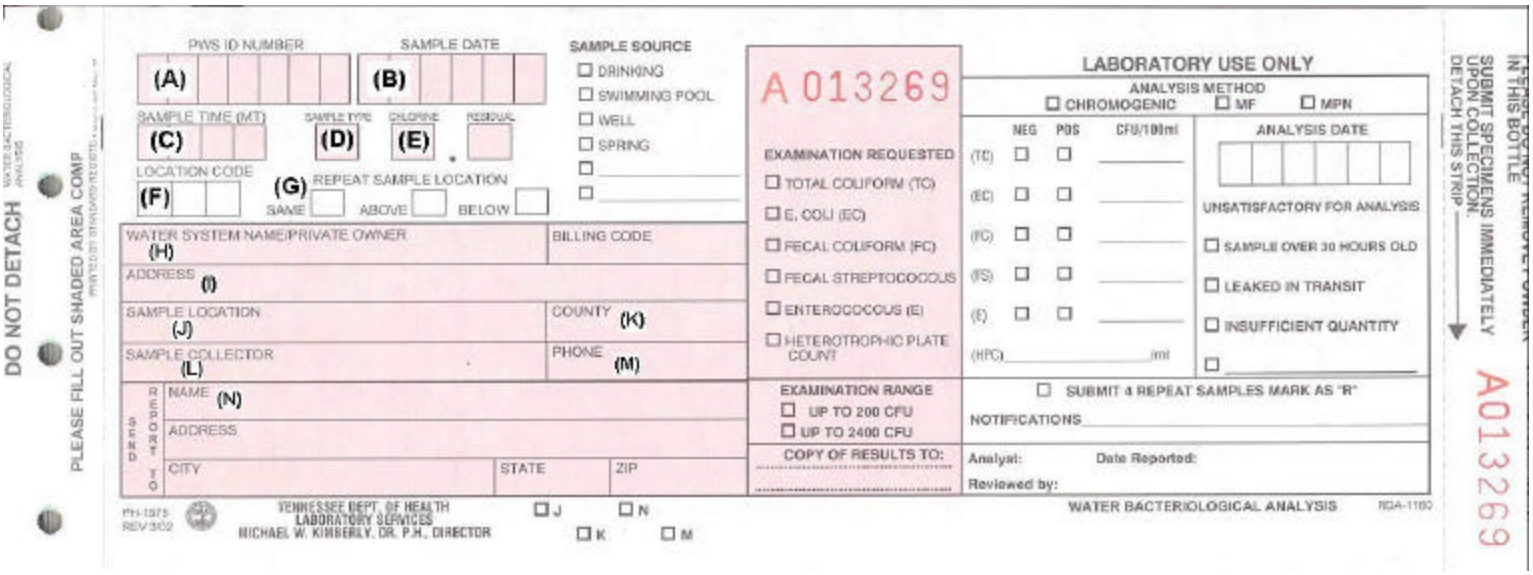
Filling Out the Water Bacteriological Analysis Form: Every time you receive a sample bottle from a state laboratory, a set of forms will be included in the package. Use care in filling out these forms. If the forms are not filled out correctly, you may be charged with a violation as our computer program can only read a properly filled-out form. Use a ballpoint pen, place on a hard surface and press hard as there are four copies in the form set.

You are required to fill in all the boxes on the form which are colored light pink. The following instructions specifically discuss these entries:

1. Print clearly on a hard surface. You are making four copies.

2. Fill in all blanks shaded light pink. Complete the form (Figure 1) as follows:

Total Coliform Rule
Sample Information Slip
Figure 1



a. **PWSID Number**. Record your full public water system identification number. Many water systems have similar names. In order that you get credit for the sample, the PWSID number must be correct.

b. **Sample date**. Record the number of the month in the first two blocks. January would be month 01 and December will be month 12. Use the third and fourth blocks to record the day of the month. Use the last two boxes to record the last two digits of the year. January 2, 2001 would read 010201. December 14, 2001 would read 121401.

c. **Sample time**. Record the time of day in military time. 8:30 a.m. would be recorded as 0830. 1:30 p.m. would be recorded as 1330. Samples collected after noon will have 12 hours added to the time using the 24-hour clock.

d. **Sample type**. Sample types are recorded as follows:

D – Routine
R – Repeat
N – New lines
S – Special
Q – Quality Control

Failure to record the correct sample type can result in a monitoring requirement violation. Most samples will be coded as a "D" for a routine sample. Follow-up samples immediately following a positive routine sample are repeat samples and are coded as "R".

e. **Chlorine Residual**. All systems that disinfect their water must record the chlorine residual when coliform samples are collected. Systems that are not required to disinfect should record 0.0 in the space provided. Chlorine residuals should be reported to the nearest one tenth of a milligram per liter or one tenth of a part per million. For example 0.24 part per million (ppm) would be recorded as 0.2; 1.25 ppm would be recorded as 1.3. See the section on sampling and testing chlorine residuals. Public water systems must use the DPD test kit to determine the chlorine residual.

f. **Location code**. This 3-digit block would only be used when repeat samples are collected. The laboratory will furnish you the numbers to be put in these blocks.

g. **Repeat Sample Location**. Same Above Below
Only used when collecting repeat "R" samples.

The regulations require that, when a positive coliform sample is found, 4 repeat samples must be collected. One of the repeat samples must be collected from the site of the original positive sample, one repeat sample within five service connections located upstream (above) of the positive sample, and one repeat sample collected within five service connections located downstream (below) of the positive sample. The fourth repeat sample may be collected from any

sampling point located within five service connections above or below the original positive sample.. If your system has only one outlet or tap, collect all the repeat samples from this tap and check the box marked "same" for all 4 samples. "Repeat samples" are samples taken to determine if there is a serious water quality problem in the distribution system. Repeat sample results may validate domestic plumbing problem rather than a water quality problem. In order to receive credit for complying with the coliform monitoring requirements you must indicate on the coliform report form whether the sample was collected at the same site, or above or below the original site. Every system collecting less than five routine samples per month must collect five routine samples the month following any month in which a positive coliform sample was found. The 5 samples taken the following month are to be coded as "D" since they are considered as routine distribution samples. Sampling at 5 samples per month must continue until all 5 routine samples are negative. Systems monitoring once a quarter are required to take five samples the next month following the month in which a positive sample was obtained.

h. **Water System Name/Private Owner**. Provide the name of the Water System or Utility District where the sample was collected.

i. **Phone**. Provide a daytime telephone number to be called by the laboratory if they need to contact you about the sample.

j. **Address**. Provide the complete mailing address of the Water System from which the sample was collected.

k. **Sample Location**. Provide sufficient information so that you can return to the sample site for repeat samples if necessary and sufficient information that the sample site can be identified on your sampling site plan.

l. **County**. Record the county where the public water system is located.

m. **Sample Collector**. Record the name of the person who actually collected the sample.

n. **Name, Address, City, Zip**. Please record the full address of the person or organization the coliform sample results should be mailed to. Make sure that this information is printed clearly because the laboratory uses this information to return the results to you.

Action Required When Lab Report is Received:

1. If the report shows the sample to be "Unsatisfactory" for any reason, the system must collect another routine sample to replace the unsatisfactory sample and submit it to the laboratory. The replacement sample is to be marked as sample type "D". Samples received more than 30 hours after collection are invalid and will not be analyzed and will

be reported as "Unsatisfactory". (There are five different boxes in this category. Any one may be checked.) Another sample must be collected and submitted to a certified laboratory. Repeat the normal procedure of sampling. Fill out the form as you did for the original sample. Mark "D" in Sample Type.

2. If the report shows "Confluent Growth-Too Numerous to Count", submit an additional sample immediately marked as "D", file the report along with other reports on your water system and keep it for at least 5 years.

3. If the report shows "Neg" (meaning negative for coliform organisms), file the report along with other reports on your water system and keep it for at least 5 years.

4. If the report shows "POS" (meaning positive for total, fecal, or E. coli), it means the laboratory found bacteria. You must submit 4-repeat samples – marked "R". Repeat samples must be collected within 24-hours of being notified of the positive results. File the analysis report along with other reports on your water system and keep it for at least 5 years. Repeat sample procedure is as follows:

   a. Obtain the "repeat sample" at the same location as the original positive making sure all sampling procedures are carefully followed. Enter the same number as the lab entered on the report in the box titled location code. Enter "R" in the box title sample type.

   b. Also collect one additional sample within 5 service connections upstream and one sample within 5 service connections downstream of the original positive sample. Also, collect a fourth repeat sample from anyone of the taps within 5 service taps upstream or downstream of the original positive tap for a total of four repeat samples. If the system has only one outlet, all the repeat samples must be collected at that outlet. The laboratory will provide the location code to be used for those repeat samples. Enter "R" in the blank for the sample type for these repeat samples. Repeat sampling is to continue until all samples are negative for total coliform.

5. If the Maximum Contaminant Level (MCL) for "Bacteria" has been exceeded for the calendar quarter, take the steps discussed in the Section titled Bacteriological Compliance (page15). File the report along with other reports on your water system and keep it for at least 5 years.

Keep a log of your sampling and analytical results. It is important that you keep a record of bacteriological sampling and the results of all samples collected. Refer to record keeping on page 38 and the sample log given in Appendix I for more information on maintaining records.

BACTERIOLOGICAL MONITORING AND TESTING

1. All samples will be tested to determine the presence (positive sample) or absence (negative sample) of total coliform. The results will be reported as positive or negative for coliform organisms. The State of Tennessee will analyze bacteriological samples from small public water systems.

2. Every public water system, both community and non-community*, will be required to take bacteriological samples each month in accordance with the following population chart. This chart shows the minimum number of samples required for all community water systems and non-community water systems using surface water or ground water under the direct influence of surface water. For larger populations, refer to the regulations.

Population Served	Samples Per Month
25 to 1,000[1]	1
1,001 to 2,500	2
2,501 to 3,300	3
3,301 to 4,100	4

[1]Includes public water systems that have at least 15 service connections, but serve fewer than 25 persons.

*Non-community water systems serving less than 1000 population and using a ground water source, not influenced by surface water (true ground water), will be required to take 1 coliform sample each quarter.

3. All public water systems must prepare and maintain a bacteriological sampling plan. Guidelines are available from the Division of Water Supply upon request.

4. Bacteriological samples should be collected at least 2 weeks prior to the end of the sampling period. This will allow time to make up samples. Owners should track samples to insure compliance with the regulations. See Appendix I for sample log.

5. Ground water systems not under the direct influence of surface water (true ground water) and serving 4,900 or fewer persons may collect all required samples on a single day provided they are collected from different sites.

6. Fecal coliform or E.coli must be determined on every routine or repeat sample that is positive for total coliform organisms. The state laboratory will automatically analyze any total coliform positive samples for fecal coliform.

7. If a sample is positive for total coliforms, 4 "repeat samples" must be collected and sent to the state laboratory. Those systems which use a certified commercial laboratory or have their own laboratory are only required to take 3 repeat samples if the population served is greater than 1000.

8. All repeat samples must be collected on the same day and within 24 hours of being notified of the positive result. One sample must be taken from the same tap where the positive sample was collected, one sample from within 5 service connections upstream of the positive sample, and one from within 5 service connections downstream of the positive sample. Those systems collecting 4 repeat samples may collect the 4th sample anywhere within the 5 upstream and 5 downstream service connections.

9. Repeat sampling must continue even after the system violates the maximum contaminant level (MCL) until all the samples in a set of repeat samples are negative. Water system operators shall try to determine the cause of the positive samples and take immediate action to correct the problem.

10. All water systems taking 4 or less microbiological samples each month are required to take 5 microbiological samples during the month following any month in which a positive coliform sample was analyzed. It is the water system's responsibility to ensure that the increase in sampling rate is met. Failure to do so will result in a monitoring violation. All non-community systems on a quarterly monitoring schedule are required to take 5 microbiological samples during the month immediately following any month in which a positive coliform sample was analyzed. These samples are to be coded as "D" in the sample type box.

Bacteriological Compliance

1. All samples, both routine distribution (D) and repeat (R), are used in determining compliance.

2. All systems collecting 39 or fewer samples each month or quarter <u>can only have one positive total coliform sample</u>. Two or more positive total coliform samples places the system in violation of the maximum contaminant level (MCL).

3. Systems collecting and analyzing 40 or more samples each month cannot have more than 5% of the samples total coliform positive (i.e. 2 positive for a system collecting 40 to 59 samples).

4. A system that has more positive total coliform samples than allowed and does not have a fecal coliform violation as described in item 5, will have a non-acute total coliform violation and will be required to give the appropriate public notification for total coliform. (See page 27 for information on giving public notification.)

5. A <u>fecal coliform</u> violation shall occur if either of the following events should happen:

a. The system has a positive total coliform repeat sample following a positive fecal coliform or E.coli routine sample; or
b. The system has a positive fecal coliform or E.coli determination on a positive total coliform repeat sample.

6. A system that has a fecal coliform violation will be classified as having an "acute" total coliform violation and will be required to give the fecal coliform public notice within 24 hours. (See page 27 for information on giving public notification.)

7. A public water system must notify the nearest Environmental Assistance Center (EAC) by the end of the business day after being notified of an E.coli or fecal coliform positive routine or repeat sample unless the state laboratory conducted the analysis.

8. A public water system which exceeds the standard for total coliform must report the violation to the state no later than the end of the next business day after discovering the violation, and give public notice within 30 days. (See page 27 for information on giving public notification.)

9. A public water system, which has failed to comply with the coliform monitoring requirements, must report the monitoring violation to the state within ten days after the system discovers the violation and also notify the public of the violation.

BACTERIOLOGICAL SAMPLING SITE PLAN

All public water systems must prepare and maintain a bacteriological sampling site plan and have it available for review by the Division of Water Supply. The objective of the plan is to insure that bacteriological samples are collected at sites that are representative of the water throughout the distribution system including dead-end lines, low use areas, residential areas and areas near storage tanks. The plan should insure that no portion of the distribution system is neglected during the course of the year. Appendix F contains guidance for the preparation of a bacteriological sampling site plan. Additional assistance can be obtained from the nearest Division of Water Supply Environmental Assistance Center Office.

SUMMARY OF CHEMICAL MONITORING REQUIREMENTS SMALL PUBLIC WATER SYSTEMS

The following tables provide a summary of the chemical analyses required of a public water system. The information provided under the "Frequency" is based on the assumption that the results of a sampling event are below a given value. If any analytical result is above a specified valve, the system will be required to take additional samples. All analyses must be done by a State Certified Laboratory. Since the certification status of a laboratory may change from time to time, it is suggested that you inquire if the laboratory chosen to perform the work is currently

certified by the State of Tennessee to conduct the requested analysis. A current updated list can always be obtained from the Division of Water Supply.

If you have any questions concerning sampling, please contact the nearest office of the Division of Water Supply at 1-888-891-8332.

NITRATE & NITRITE – Required of all public water systems; community (CWS), non-transient non-community (NTNCWS), and transient non-community (TNCWs) water systems

System Type	Contaminant	Source	MCL	Frequency
TNCWSs	Nitrate	Ground	10 mg/L	Annually with the first sample required within 3 months of system activation.
		Surface	10 mg/L	Quarterly with the first sample required within 3 months of activation. Frequency may be reduced by the state after 4 quarterly samples.
	Nitrite	Ground	1.0 mg/L	One sample within 3 months of being activated. Additional samples may be required if directed by the state.
		Surface	1.0 mg/L	One sample within 3 months of being activated. Additional samples may be required if directed by the state
CWSs & NTNCWSs	Nitrate	Ground	10 mg/L	Annually with the first sample required within 3 months of system activation.
		Surface	10 mg/L	Quarterly with the first sample required within 3 months of activation. Frequency may reduced by the state after 4 quarterly samples
	Nitrite	Ground	1.0 mg/L	One sample within 3 months of being activated. Additional samples may be required if directed by the state
		Surface	1.0 mg/L	One sample within 3 months of being activated. Additional samples may be required if directed by the state

The following tables contain the chemicals that all community and non-transient non-community water systems must sample for unless the state has granted the system a waiver.

INORGANICS – APPLIES ONLY TO COMMUNITY AND NON-TRANSIENT NON-COMMUNITY WATER SYSTEMS

Contaminant	MCL in mg/L	Source	Frequency
Antimony Arsenic Beryllium Barium Cadmium Chromium Cyanide Fluoride Mercury Nickel Selenium Thallium	0.006 0.05 0.004 2.0 0.005 0.1 0.2 4.0 0.002 0.1 0.05 0.002	ground	1 sample every 3 years
		surface	1 sample every year. Frequency may be reduced after 3 years of data is collected
Asbestos	7 million fibers/liter longer than 10 microns	Ground and surface	All systems with asbestos cement pipe must take 1 initial sample from the distribution system. State may reduce frequency to 1 sample every 9 years after initial sampling. Waivers for asbestos monitoring may be issued if the distribution system does not contain any asbestos material.

LEAD AND COPPER – APPLIES ONLY TO COMMUNITY AND NON-TRANSIENT NON-COMMUNITY WATER SYSTEMS

Contaminant	Action Level mg/L	Action level	Number of Samples
Lead	0.015	Based on 90th percentile	Based on population served with minimum of 5 samples every 6 months.
Copper	1.3	Based on 90th percentile	Based on population served with minimum of 5 samples every 6 months.

Reduced lead and copper monitoring schedules and waivers are available for systems that qualify.

SYNTHETIC ORGANIC CHEMICALS (SOCs) – APPLIES ONLY TO COMMUNITY AND NON-TRANSIENT NON-COMMUNITY WATER SYSTEMS.

Contaminant	MCL in mg/L	Frequency
Alachlor	0.002	4 consecutive quarterly samples every 3 years. The State may issue waivers based upon use, transport, storage or disposal in the watershed or zone of influence of a well. Contact the nearest Environmental Assistance Center for information on waivers.
Atrazine	0.003	
Carbofuran	0.04	
Chlordane	0.002	
Dibromochloropropane (DBCP)	0.0002	
2,4 D	0.07	
Ethylene dibromide	0.00005	
Heptachlor	0.0004	
Heptachlor epoxide	0.0002	
Lindane	0.0002	
Methyoxychlor	0.04	
Polychlorinated biphenyls(PCBs)	0.0005	
Toxaphene	0.003	
2,4,5 TP	0.05	
Pentachlorophenol	0.001	
Benzo(a)pyrene	0.0002	
Dalapon	0.2	
Di(2-ethylhexyl) adipate	0.4	
Di(2-ethylhexyl) phthalate	0.0006	
Dinoseb	0.007	
Diquat	0.02	
Endothall	0.1	
Glyphosate	0.7	
Hexachlorobenzene	0.001	
Hexachlorocyclopentadiene	0.05	
Oxamyl (Vydate)	0.2	
Picloram	0.5	
Simazine	0.0004	
2,3,7,8 – TCDD (Dioxin)	0.00000003	
Endrin	0.002	

VOLATILE ORGANIC CHEMICALS (VOCs) – APPLIES ONLY TO COMMUNITY AND NON-TRANSIENT NON-COMMUNITY WATER SYSTEMS.

Contaminant	MCL in mg/L	Frequency
Trichloroethylene	0.005	4 consecutive quarterly samples every 3 years. If no detects then sampling may be reduced to 1 sample per year
Carbon tetrachloride	0.005	
Vinyl chloride	0.002	
1,2 Dichloroethane	0.005	
Benzene	0.005	
1,1 Dichloroethylene	0.007	
1,1,1 Trichloroethane	0.20	
papa-Dichloropropane	0.075	
cis 1,2 Dichloroethylene	0.07	
1,2 Dichloropropane	0.005	
Ethyl benzene	0.7	
Monochlorobenzene	0.1	
ortho-Dichlorobenzene	0.6	
Styrene	0.1	
Tetrachloroethylene	0.005	
Toluene	1.0	
trans 1,2 Dichloroethylene	0.1	
Xylenes (total)	10.0	
Dichloromethane	0.005	
1,2,4 Trichlorobenzene	0.07	
1,1,2 Trichloroethane	0.005	

UNREGULATED CHEMICALS

Community water systems serving 10,000 or more persons and selected smaller systems must periodically test for certain unregulated contaminants. Consult with the nearest Environmental Assistance Center for details on the applicability and frequency for monitoring unregulated contaminants required for your system.

RADIOCHEMICALS – APPLIES ONLY TO COMMUNITY WATER SYSTEMS.

CONTAMINANT	MCL in pCi/L	SOURCE TYPE	FREQUENCY
Gross Alpha	15	Ground & Surface	4 consecutive quarterly samples from each entry point to the distribution system with the first sampling period ending December 31, 2007.
Radium 226	Combined Radium 226 and 228 cannot exceed 5.	Ground & Surface	4 consecutive quarterly samples from each entry point to the distribution system with the first sampling period ending December 31, 2007. Do not have to monitor if Gross Alpha is less than 5 pCi/L.
Radium 228	Combined Radium 226 and 228 cannot exceed 5.	Ground & Surface	4 consecutive quarterly samples from each entry point to the distribution system with the first sampling period ending December 31, 2007. Do not have to monitor if Gross Alpha is less than 5 pCi/L.
Uranium	30 μg/L.	Ground & Surface	4 consecutive quarterly samples from each entry point to the distribution system with the first sampling period ending December 31, 2007. Do not have to monitor if Gross Alpha is less than 15 pCi/L.
Gross Beta & Photon Radioactivity	Total Body or Organ Dose of 4 MREM/Year	Ground & Surface	Monitoring required only if directed to monitor by the state.

Frequency – Provided the state approves, systems may use historical monitoring data to satisfy the initial monitoring requirements if the data were collected between June 2000 and December 8, 2003 to meet the December 31, 2007 monitoring deadline.

SECONDARY CHEMICALS – APPLIES TO ALL COMMUNITY WATER SYSTEMS AND THOSE NON-COMMUNITY WATER SYSTEMS SPECIFICALLY DIRECTED TO MONITOR BY THE STATE.

Contaminant	MCL in mg/L	Source Type	Frequency
Chloride	250	Ground	Monitor every 3 years.
Color	15 color units		
Copper	1.0		
MBAS	0.5		
Iron	0.3		
Manganese	0.05		
pH	6.5-8.5	Surface	Monitor every year.
Sulfate	250		
Odor	3 (threshold odor number)		
TDS	500		
Zinc	5.0		
Fluoride	2.0		

SODIUM AND CORROSIVITY - APPLIES TO ALL COMMUNITY WATER SYSTEMS.

Contaminant	MCL in mg/L	Source Type	Frequency
Sodium*	No Standard	Ground	1 sample every 3 years.
		Surface	1 sample every year.
Corrosivity	No Standard	Ground	1 sample from the entry point.
		Surface	1 winter sample and 1 summer sample from each entry point.

*Community water systems must notify the appropriate local and state public health officials of the sodium levels by written notice using direct mail within three months of obtaining the analytical results and to the Department 10 days after receipt of the analyses and after notifying public health officials.

SAMPLING AND TESTING FOR NITRATE AND NITRITE

Reason for test: A small amount of nitrate and nitrite in water can be harmful to babies who are younger than 6 months. Nitrate in water interferes with a baby's ability to transfer the oxygen in

the air it breathes to the bloodstream. This can result in "blue baby" symptoms where the infant appears to be suffocating. Adults generally are not affected.

Nitrate: All public water systems must monitor to determine compliance with the MCL for nitrate. The monitoring rules state that:

(1) Community, non-transient non-community, and transient non-community water systems served by groundwater systems shall monitor annually.

(2) For community and non-transient non-community water systems, the repeat monitoring frequency for ground water systems shall be quarterly for at least one year following any one sample in which the concentration is greater than 50 percent of the MCL.

(3) Community and non-transient non-community water systems using surface water may be allowed by the state to reduce the sampling frequency to annually if all analytical results from four consecutive quarters are less than 50 percent of the MCL. A surface water system must return to quarterly monitoring if any sample is greater than 50 percent of the MCL.

(4) Each transient non-community water system shall monitor annually.

(5) After the initial round of quarterly sampling is completed, each community and non-transient non-community system that is monitoring annually shall take subsequent samples during the quarters which previously resulted in the highest analytical result.

(6) All new public water systems must begin monitoring within three (3) months of being activated as a public water system.

Nitrite:

(1) All public water systems must test for nitrite.

(2) After the initial sample, systems where the analytical result for nitrite is less than 50 percent of the MCL shall monitor at the frequency specified by the state.

(3) All water systems must conduct repeat monitoring at least quarterly for one year following any one sample in which the concentration is greater than 0.5 mg/L. The state may allow a system to reduce the sampling frequency to annually after determining the system is reliably and consistently below the MCL.

(4) Systems that monitor annually shall take subsequent samples during the quarter that previously resulted in the highest analytical result.

(5) All new public water systems shall monitor for nitrite within three (3) months of being activated as a public water system.

Taking the water sample for a nitrite and nitrate test: Contact a certified laboratory and arrange for a sample bottle to be sent to you. The laboratory should also send instructions on how to take the sample. Use the same care in taking this sample as you did in taking the biological sample previously described. Follow the instructions given by the laboratory. Return the sample to the certified laboratory for analysis.

Action Required When Lab Report is Received: When you received the "Chemical Analysis Report Form" from a laboratory, chances are good that your water has <u>not</u> exceeded the MCL (maximum contaminant level) of 10.0 mg/L (milligrams per liter). If it has not, your only responsibility is to:

1. Send a copy of the report to the state. (Although the Lab is supposed to send a copy to the state. To be sure, you should also send a copy to the state.)

2. Keep a copy in your file for at least 10 years.

If the MCL for nitrate is exceeded, take the steps in the flow chart shown in Figure 2.

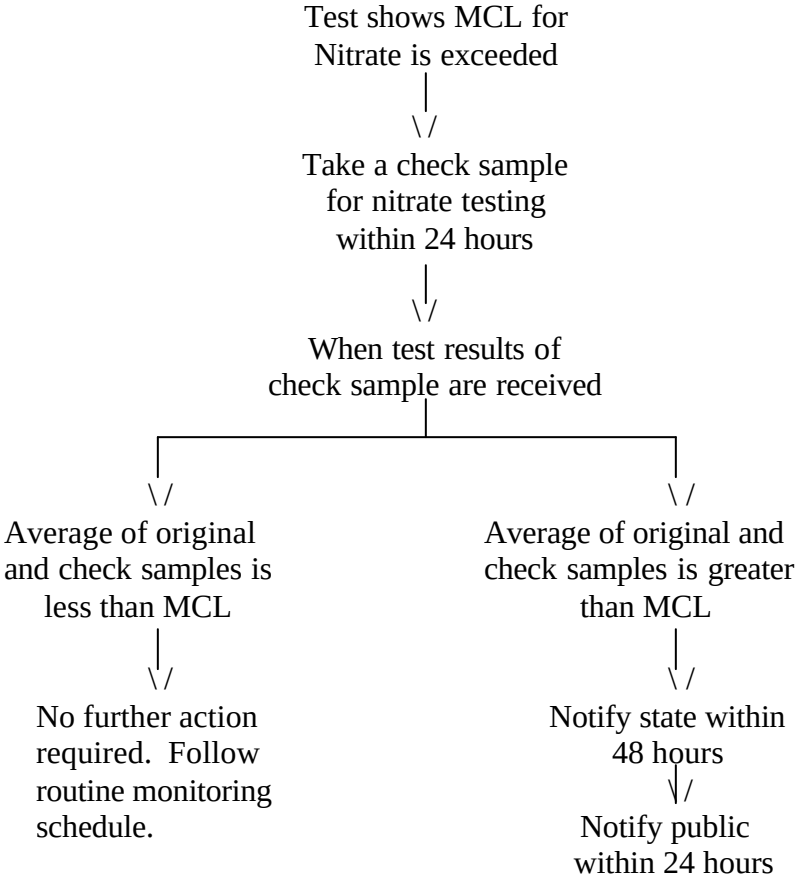


Figure 2. Action When MCL for Nitrate is Exceeded

Prevention of Nitrate Contamination: If you obtain your water from a well and the nitrate MCL is exceeded, there isn't a quick way to cure the situation. If your water comes from a surface supply, the following precautions will minimize the problem:

1. Keep all septic tanks and drain fields away from your water well.

2. See that there are no animal wastes, rubbish dumps, or wastewater discharge points near your water intake.

3. Make sure that adjacent rain runoff is not across a fertilized field and that fertilizer is not stored near your water intake.

ARE YOU REQUIRED TO MONITOR TURBIDITY?

Your Water Source is the Basis for this Requirement: If you obtain your water from a surface supply, a ground water source under the direct influence of surface water, or if the Tennessee Division of Water Supply has specifically designated your system for turbidity monitoring, then you must monitor for turbidity at least once every four (4) hours that you obtain water from a stream, lake, spring, or other source unless the state has approved the use of a continuous monitor and recorder or has accepted one (1) sample per day as being adequate.

Why Turbidity is Important: Turbidity or cloudiness of water is caused by tiny particles of material in water. The treatment technique (TT) requirement is 0.5 nephelometric turbidity units (NTUs) as measured with a nephelometric meter. (The human eye can not detect turbidity in water until more than 5 turbidity units are present). While the particles may be harmful themselves, the more important aspect is that these particles often shield harmful bacteria from disinfection. It is also the basis for assurance that any giardia or cryptosporidium cysts that may be present have been removed.

Who does the Testing? You may make arrangements for an approved laboratory to do the testing. Most community water systems with a surface water source have been approved to perform turbidity tests, so you might make arrangements with one of these systems. Since you are required to perform this test at least once every day your water system is in operation, it may be more convenient and less expensive to do it yourself. If so, you will need to purchase a nephelometric turbidimeter. A list of some of the instruments available is found in Appendix B. In order for the results to be acceptable, the person performing the analysis must be approved by the state. Contact the nearest environmental assistance center (EAC) to make arrangements for this approval.

Taking the Sample: If you have a water treatment system, take the samples as close as possible to the point where water leaves the treatment equipment. If the state has required you to sample for turbidity as a precaution and you have no treatment equipment, take your sample at the well before the water goes into your distribution system.

Use a clean container – a mason jar is acceptable. Fill and empty the container three times with the water to be sampled and cap the sample container.

Run the test as soon as possible after sampling and always on the same day the sample was collected.

Record the results on a monthly operation report (MOR) form that has space for each day of the month your system operates.

Reporting Results: If your daily result meets treatment technique (TT) standards, then you need only report the results once each month to the Water Supply Central Office in Nashville. This routine reporting (MOR) must reach the Water Supply Central Office in Nashville no later than 10 days following the end of each month.

If the analysis of any sample shows more than 5 nephelometric turbidity units (NTUs), the following action is required:

> If any sample result for turbidity is 5 NTU or greater, the water supplier must report this to the Water Supply Environmental Assistance Center in your area as soon as possible but no later than the close of the following business day. The system is required to issue an "acute" public notice if it fails to consult with the state within 24 hours following a turbidity value of 5 NTUs or more.

The system must report the following information:

(1) The total number of filtered water turbidity measurements taken during the month.

(2) The number and percentage of filtered water turbidity measurements taken during the month which are less than or equal to the applicable limits specified in Division Rule 1200-5-1-.06(3) or 1200-5-1-.31(4), whichever is applicable.

(3) The date and value of any turbidity measurements taken during month which exceed 5 NTU.

IS DISINFECTION OF YOUR WATER REQUIRED?

Your Raw Water Quality Is the Basis for This Requirement: Just as in the case of turbidity monitoring, if your source of water is from a surface supply then you are required to disinfect your water before it enters your distribution system.

If your water system has trouble meeting the MCL for bacteriological contamination ("bacteria") then you will be directed to continuously disinfect the water.

Chlorination: Chlorine and chlorine compounds such as household bleach are the most commonly used disinfectants. Unless you have a large water system (e.g., an industrial supply), you will use a chlorine compound to provide the chlorine in your water supply. Compounds commercially available are sodium or calcium hypochlorite. Calcium hypochlorite may be obtained, dry, packed in cans or drums. Prepared solutions of sodium hypochlorite are available such as household or commercial bleach or swimming pool chlorine. See Appendix C which describes the preparation of chlorine solutions. It is strongly recommended that a system use only bleach that is National Sanitation Foundation (NSF) approved for use in potable water. In the past, the use of bleach from the grocery store such as "Clorox" has been acceptable. However, many companies have begun placing additives in these bleach products, making them unacceptable for use in potable water. Care must be used in selecting a bleach to disinfect the water. It is strongly suggested that only NSF approved bleach be used.

Chlorination Equipment: The most common equipment used for chlorination of small water systems is a hypochlorinator. These devices pump or inject a chlorine solution into the water. When they are properly maintained, hypochlorinators provide reliable chlorination. Concentrated chlorine compounds are very corrosive and will cause deterioration of copper and metal pipes.

Types of hypochlorinators include positive displacement pumps, aspirator feeders, suction feeders, and tablet hypochlorinators. The Department recommends that you use only a positive displacement pump, as it is far more reliable than the other devices mentioned.

Other Means of Disinfection: Ultraviolet light is sometimes used for small systems. The quantity of ultraviolet light needed depends on such factors, as turbidity, color, and dissolved iron salts. Ultraviolet light disinfection is not acceptable as the sole disinfection process for use on surface waters or ground water under the direct influence of surface water.

PUBLIC NOTIFICATION OF VIOLATIONS

When are Public Notices Required? Tennessee law and regulations require that a public water system notify the public in the following circumstances: Public notice must be given for failure to comply with maximum contaminant levels, maximum residual disinfectant levels, required treatment techniques, failure to conduct monitoring, disease outbreaks, exceedances of the short term turbidity limits, availability of unregulated contaminant monitoring data, and other violations and situations determined by the State.

PUBLIC NOTICES

EVENTS REQUIRING PUBLIC NOTICE	TIMING OF THE NOTICE	DELIVERY OF THE NOTICE
Tier 1 Notices include: 1. Violation of E.coli/fecal coliform standards; 2. Violation of Nitrate, Nitrite, or total Nitrate MCL or when the system fails to take confirmation samples within 24 hours of the system's receipt of analysis showing Nitrate or Nitrite MCL violations; 3. Violation of the Maximum Residual Disinfectant Level (MRDL) for chlorine dioxide in the distribution system or failure to sample for chlorine dioxide in the distribution system following an entry point chlorine dioxide MRDL exceedance; 4. Violation of the maximum turbidity treatment technique limits for a single exceedance limit; 5. Occurrence of a waterborne disease outbreak, and; 6. Other events having a significant potential to result in serious adverse health effects on customers.	As soon as possible, but no later than 24 hours after the system learns of the violation. Consultation with the Department should be made in less than 24 hours. When consultation with the Department does not take place within the 24-hour period for turbidity violations, the water system must distribute a Tier 1 notice of the violation within the 24-hour time period.	The delivery method must be calculated to reach all persons served water. Use one or more of the following: 1. Broadcast media. 2. Posting the notice in conspicuous places. 3. Hand delivery or other method approved by the Department. 4. Other methods approved by the Department.
Tier 2 Notices include: 1. All violations of MCL, MRDL, and treatment techniques not requiring Tier 1 notice and;	As soon as practical, but not later than 30 days after the system learns of the violation. A posted notice	Community systems must: 1. Mail or directly deliver to each customer

2. Failure to use proper monitoring or testing techniques.	must remain in place for at least 7 days even though the violation may have been corrected. Notice must be repeated every 90 days as long as the violation persists	receiving a bill and to other service connections to which water is delivered, and; 2. Other methods reasonably calculated to reach other persons regularly served by the system; Non-community systems may: 1. Post the notice in conspicuous locations or other methods reasonably calculated to reach persons served by the system.
Tier 3 Notice include: 1. Failure to comply with testing procedures; 2. Availability of unregulated contaminant monitoring results; 3. Exceedance of the fluoride secondary standard.	Notice must be given not later than 1 year after learning of the violation. Notices must be repeated as long as the violation persists.	Community Systems: 1. Must mail or directly deliver the notice to each customer and; 2. Other methods calculated to reach customers of the system. Non-community Systems: 1. May post the notice in conspicuous locations.

CONTENT OF PUBLIC NOTICES

What must be included in the public notice for violations of National Primary Drinking Water Regulations (NPDWR) or other situations requiring a public notice? When a public water system violates a NPDWR or has a situation requiring public notification, each public notice must include the following elements:

1. A description of the violation or situation, including the contaminant(s) of violation, and the contaminant level(s);

2. The date or dates that the violation or situation occurred;

3. Any potential adverse health effects from the violation or situation, found in Rule 1200-5-1-.19 of Tennessee's Public Water System Regulations.

4. The population at risk, including subpopulations (i.e. immune compromised, infants, elderly, etc.) particularly vulnerable if exposed to the contaminant in their drinking water;

5. Whether alternative water supplies should be used;

6. What actions consumers should take, including when they should seek medical help, if known;

7. What the system is doing to correct the violation or situation;

8. When the water system expects to return to compliance or resolve the situation;

9. The name, business address, and phone number of the water system owner, operator, or designee of the public water system as a source of additional information concerning the notice; and

10. A statement to encourage recipients of the notice to distribute the public notice to other persons served by the system that would not ordinarily receive the notice.

Total Coliform

If your public water system exceeds the MCL for total coliform as a minimum the following public notice must be delivered to your customers:

Public Notice

_____
(Date posted)

Dear User:

The United States Environmental Protection Agency (EPA) requires that we send you this notice on the level of total coliforms found in your drinking water.
___*1___sample(s) were collected and analyzed during _____*2_____. __*3__
number month and year
_____sample(s) contained total coliforms.
number

The United States Environmental Protection Agency (EPA) sets drinking water standards and has determined that the presence of total coliforms is a possible health concern. Total coliforms are common in the environment and are generally not harmful themselves. The presence of these bacteria in drinking water, however, generally is a result of a problem with water treatment or the pipes which distribute the water, and indicates that the water may be contaminated with organisms that can cause disease. Disease symptoms may include diarrhea, cramps, nausea, and possible jaundice, and any associated headaches and fatigue. These symptoms, however, are not just associated with disease-causing organisms in drinking water, but also may be caused by a number of factors other than your drinking water. EPA has set an enforceable drinking water standard for total coliforms to reduce the risk of these adverse health effects. Under this standard, no more than 5.0 percent of the samples collected during a month can contain these bacteria, except that systems collecting fewer than 40 samples/month that have one total coliform-positive sample per month are not violating the standard. Drinking water that meets this standard is usually not associated with a health risk from disease-causing bacteria and should be considered safe.

For further information contact ** at your water system.
*1 – The number of bacteriological samples collected that month.
*2 – The month and year the sampling was done.
*3 – The number of samples positive for total coliform.

**The public water system shall insert the name, address, and telephone number of a contact person at the public water system.

If you exceed the MCL for fecal coliforms, as a minimum the following language must be used:

Fecal Coliforms. This notice shall be used by systems that violate the maximum concentration limit for fecal coliform/E.coli in 1200-5-1-.06(4)(b) or both 1200-5-1-.06(4)(a) and (b) and shall contain the following language except as necessary to replace the asterisks:

Public Notice

_____

(Date Posted)

Dear Users:

The United States Environmental Protection Agency (EPA) requires that we send you this notice on the level of fecal coliforms/E.coli found in your drinking water. ___*1___sample(s) were collected and analyzed during _____*2_____. __*3__
number month and year
_____sample(s) contained fecal coliform or E.coli.
number

The United States Environmental Protection Agency (EPA) sets drinking water standards and has determined that the presence of fecal coliforms or E.coli is a serious health concern. Fecal coliforms and E.coli are generally not harmful themselves, but their presence in drinking water is serious because they usually are associated with sewage or animal wastes. The presence of these bacteria in drinking water is generally a result of a problem with water treatment or the pipes which distribute the water, and indicates that the water may be contaminated with organisms that can cause disease. Disease symptoms may include diarrhea, cramps, nausea, and possible jaundice, and associated headaches and fatigue. These symptoms, however, are not just associated with disease-causing organisms in drinking water, but also may be caused by a number of factors other than your drinking water. EPA has set an enforceable drinking water standard for fecal coliforms and E.coli to reduce the risk of these adverse health effects. Under this standard all drinking water samples must be free of these bacteria. Drinking water which meets this standard is associated with little or none of this risk and should be considered safe. State and local health authorities recommend that consumers take the following precautions: (To be inserted by the public water system, according to instructions from State or local authorities).

For further information contact ** at your water system.
*1 – The number of bacteriological samples collected that month.
*2 – The month and year the sampling was done.
*3 – The number of samples positive for total coliform.

**The public water system shall insert the name, address, and telephone number of a contact person at the public water system.

Water systems must also give public notice if chemical tests show the MCL was violated for chemicals for which there are drinking water standards. Community (CWS) and Non-transient Non-community systems (NTNCWS) are required to give notice to their customers of the availability of results of special sampling for organic chemicals that are listed in Rule 1200-5-1-.28 within three months of obtaining the analytical results. Specific language must be used for certain chemicals when the MCL is exceeded. This language may be found in Rule 1200-5-1-.10 of Public Water System Supply Regulations or may be obtained from any field office (located in the environmental assistance center) or the central office of the Division of Water Supply.

1. If you exceed the MCL for nitrate, as a minimum the following language must be used:

   Nitrate. The Unites States Environmental Protection Agency (EPA) sets drinking water standards and has determined that nitrate poses an acute health concern at certain levels of exposure. Nitrate is used in fertilizer and is found in sewage and wastes from human and/or farm animals and generally gets into drinking water from those activities. Excessive levels of nitrate in drinking water have caused serious illness and sometimes death in infants under six months of age. The serious illness in infants is caused because nitrate is converted to nitrite in the body. Nitrite interferes with the oxygen carrying capacity of the child's blood. This is an acute disease in that symptoms can develop rapidly in infants. In most cases, health deteriorates over a period of days. Symptoms include shortness of breath and blueness of the skin. Clearly, expert medical advice should be sought immediately if these symptoms occur. The purpose of this notice is to encourage parents and other responsible parties to provide infants with an alternate source of drinking water. Local and State health authorities are the best source for information concerning alternate sources of drinking water for infants. EPA has set the drinking water standard at 10 parts per million (ppm) for nitrate to protect against the risk of these adverse effects. EPA has also set a drinking water standard for nitrite at 1 ppm. To allow for the fact that the toxicity of nitrate and nitrite are additive, EPA has also established a standard for the sum of nitrate and nitrite at 10 ppm. Drinking water that meets the EPA standard is associated with little to none of this risk and is considered safe with respect to nitrate.

2. If you exceed the MCL for nitrite, the following language must be used:

   Nitrite. The Unites States Environmental Protection Agency (EPA) sets drinking water standards and has determined that nitrite poses an acute health concern at certain levels of exposure. This inorganic chemical is used in fertilizer and is found in sewage and wastes from human and/or farm animals and generally gets into drinking water from those activities. While excessive levels of nitrite in drinking water have not been observed, other source of nitrite have caused serious illness and sometimes death in infants under six months of age. The serious illness in infants is caused because nitrite interferes with the oxygen carrying capacity of the child's blood. This is an acute disease in that symptoms can develop rapidly. However, in most cases, health deteriorates over a period of days. Symptoms include shortness of breath and blueness of the skin. Clearly, expert medical advice should be sought immediately if these symptoms occur. The purpose of

this notice is to encourage parents and other responsible parties to provide infants with an alternate source of drinking water. Local and State health authorities are the best source for information concerning alternate sources of drinking water for infants. EPA has set the drinking water standard at 1 part per million (ppm) for nitrite to protect against the risk of these adverse effects. EPA has also set a drinking water standard for nitrate (converted to nitrite in humans) at 10 ppm and for the sum of nitrate and nitrite at 10 ppm. Drinking water that meets the EPA standard is associated with little to none of this risk and is considered safe with respect to nitrite.

3. If you exceed the turbidity MCL, the following language may be used:

Water System Temporarily Closed

This water system is temporarily closed to protect your health. A recent test shows it doesn't meet the turbidity standard of the Tennessee Safe Drinking Water Act. We're working on it and hope to have safe water service restored in a few days.

4. If you must conduct monitoring for the unregulated inorganic and organic chemicals of Group I and Group II, then you must notify persons served by the system of the availability of the sampling results by including the notice in the first set of water bills issued by the system after receipt of the results or by written notice within three months.

5. If you exceed the MCL for any other contaminant, contact the nearest environmental assistance center of the Division of Water Supply for the specific language that must be used in the public notice.

   A copy of the public notice and the dates and locations it was posted must be transmitted to the Division of Water Supply within 10 days of the completion.

DISTRIBUTION SYSTEM

Every public water system, even a small water system, has a distribution system. A distribution system is a series of pipes and apparatus used in transporting water from the source or treatment plant to the consumer. A distribution system can include all piping including service lines, valves, hydrants, fire hydrants, air release valves, meters, backflow preventers, pumps, storage tanks, etc. needed to insure the delivery of safe dependable water to the customer. While the water treatment plant is designed and operated to produce water that meets drinking water standards, the distribution system must be designed and operated to maintain the quality of the water being delivered to the user. Water age due to storage in pipes and tanks is a major factor in water quality deterioration within the distribution system. Most water systems are designed with excess capacity. Too much excess capacity aids the deterioration of water quality. As drinking water ages the pH usually drops, corrosion, taste, odor, color and bacteria increases, and chlorine residuals drops.

Design

Anytime a water system is designed or a change is made to the water distribution system, the quality of the treated drinking water is potentially compromised. Care must be taken when grounding any electrical apparatus to the water line, designing storage tanks, changing out hydrants, valves, backflow preventers, meters, etc. to insure that the quality of water in the system is maintained to the same level as that produced by the treatment plant. Connecting dissimilar metal pipe materials together is a distribution system accelerates corrosion. Poor operation of the distribution system can cause water quality problems and could cause waterborne illnesses to occur. Therefore, the integrity of the distribution system must be maintained to prevent contamination of the water.

Monitoring

Distribution systems should be routinely monitored to determine the quality of the water. Bacterial density, presence of cross connections, free chlorine residual, corrosion inhibitor residual, corrosion products, temperature, and pressure can and should be used to determine the quality of water stored in the distribution system.

Flushing

All distribution systems need to be flushed periodically and at least once each year. There is not a set schedule that can be used for all water systems to determine the flushing schedule. The flushing schedule established for your system should take into account the size of the lines, volume of water used, storage tanks, and dead end lines. Dead end lines that have low water usage will have to be flushed more often than a main transmission line with a lot of water usage. Failure to maintain an adequate flushing program can lead to a number of problems including taste and odor, low chlorine residual, rust and scale buildup, increase in the number of microbiological organisms, etc.

Another concern regarding flushing programs is maintaining the quality of water in the distribution system. Distribution systems that fail to maintain the quality of water in the distribution system eventually develop biofilms that attach to the walls of the pipe.

Water systems should develop a flushing program that will maintain the quality of water throughout the entire distribution system. A good flushing program will include the following:

> Identification of the criteria that will be used to trigger flushing including such things as residence time of water in the lines, construction materials used for the line, temperature of the water, corrosion inhibitor residuals, chlorine residual, heterotrophic plate counts, taste, odor, and disinfection byproduct (DBP) levels.
>
> A method to determine the flow velocity needed to remove sediment, the size of the flush valve needed to create the desired velocity, and the length of flushing time needed to maintain or restore water quality.

Identification of the criteria used to determine if the flushing was successfully.

Map showing location of flush valves or hydrants and valves.

Provisions for sanitizing construction materials, disinfecting, flushing and collecting bacterial samples after the repair of lines.

Recordkeeping procedures needed to document adequate flushing programs and satisfactory bacterial results.

Apartment complexes, campgrounds, and seasonal water systems are special cases that require attention. Corrosion of pipe and fixtures in unoccupied buildings usually results in the first draw water containing excess lead and copper concentrations. Water lines should be flushed before vacant rooms or apartments are reoccupied. School systems should always flush all lines before resuming classes after vacation periods lasting more than a three or four days.

Chlorine Residual

Water systems that must disinfect their water to comply with the total coliform rule must maintain a disinfectant residual of 0.2 mg/L or ppm throughout the entire distribution system. Failure to be able to maintain the disinfectant at the appropriate level general indicates a problem in the distribution system. Contamination through a cross connection, improper water line repairs, improper flushing program can all lead to failure of being able to maintain an adequate disinfectant residual. While 0.2 mg/L of free chlorine residual is required for systems that disinfect, research indicates that free chlorine a concentration approaching 2.0 mg/L is needed to inhibit and control biofilm formation in distribution systems. The American Water Works Association reports it takes about 3000 times as much free chlorine to inactivate a bacteria in biofilms as it does a free swimming organism outside the biofilm.

Repairs and New construction

It is important to keep all materials used in the construction, repair and maintenance of distribution systems clean and disinfected. Newly installed lines should be disinfected and flushed after installation. The bacterial quality of the water from new lines should be monitored and documented by laboratory reports before the water is served to customers. After repair to a line, the line should be cleaned, disinfected and flushed. The repaired or new line should be flushed to remove the heavily chlorinated water to prevent injury to customers by the chlorine. Caution must be taken to ensure that the highly chlorinated water is not released in a manner that it will reach a stream or body of water.

All new lines and repairs must be done in a satisfactory manner to protect public health. In general, the following procedure must be followed:

1. All materials used in a repair or new installation shall be clean and in like new condition. Steps must be taken to prevent any contamination from reaching the materials used in a repair or line installation while the material is in storage.

2. Repair parts must be disinfected by swabbing out the parts and the ends of the line being repaired with a 10% solution of bleach.

3. The line must be flushed following the repair and a microbiological sample must be collected and sent to a state certified laboratory to confirm the procedure used in the repair.

4. If there is a question on the procedure to follow while repairing or installing a line, please consult with the American Water Works Association Standard C651-99.

Pressure

If low pressure occurs in a distribution system, it is possible for fluids of unknown or unsafe quality to intrude into the distribution pipes and tanks. Steps should be taken in maintaining the distribution system to maintain a minimum of 20 pounds per square inch pressure. If a pressure drop occurs, then the water from the area affected by the low pressure should be considered potentially contaminated and treated accordingly by flushing or by monitoring.

Permeation

Many pipe and gasket materials such as polyvinyl chloride, high-density polyethylene, are permeable by contaminants. Care should be exercised to avoid installing permeable pipes through areas where soil contamination could be a problem. Gasoline and solvents are commonly reported to permeate plastics lines.

Leaching

Contaminants commonly leach from some pipe and fixtures. Vinyl chloride monomer is known to leach from pre-1997 PVC pipes. Aluminum comes from cement pipes. Asbestos leaches from asbestos cement pipe. Lead and copper leaches from copper and lead pipes and joints. Alkyl benzenes and polynuclear aromatic hydrocarbons leach from bituminous coating and linings. All pipe material, coatings, fixtures and treatment chemicals should be National Sanitation foundation approved. Biofilms and low pH generally accelerate leaching.

CROSS-CONNECTIONS

What is a Cross-connection? Unsafe and contaminated water doesn't belong in your system but it can end up there if you are not careful. A cross-connection is a potential or actual link between the drinking water supply line and any pipes or devices that contain polluted water, or water of unknown quality. Backflow of polluted water into drinking water lines can occur if for some reason the drinking water lines lose pressure. It can also occur when water lines are connected to some device containing fluids under high pressure such as an industrial, residential, or commercial boiler. Backflow can also occur if the public water lines are connected to a home or business using a well for an auxiliary water supply. The common garden hose is responsible for many cross-connections because it is usually submerged in the container it is used to fill.

How can backflow be prevented? Maintaining an air gap between drinking water and unsafe liquids is the most effective means of backflow prevention. Backflow prevention is enhanced by maintaining reasonable pressures at all times in the public water system lines and notifying customers when water will be shut off. Backflow can also be prevented by installing special valves in the water lines called backflow prevention devices. Tennessee Law prohibits allowing cross-connections to occur. It is important that non-community water systems be aware that cross-connections can introduce bacteria and chemicals into drinking water lines. It is the responsibility of the water supplier to prevent contamination of public water systems from backflow.

Backflow or the reversal of flow in water lines may occur as the result of backsiphonage or by backpressure. Never submerge the end of a water hose or water supply line into any liquid that is not safe to drink. Any loss of pressure in the water system could cause backsiphonage.

OPERATIONS AND MAINTENANCE

1. Non-community water systems, which are classified as a surface supply, will be required to have a full time operator in attendance unless certain continuous monitoring equipment approved by the state is installed.

   All operators in direct responsible charge of a public water supply system, including the treatment plant and/or distribution system, must be certified by the department to operate the system. A certified operator must be available at all times to make program control decisions that could affect the quality or quantity of water being distributed.

2. All community water systems (CWS) and those non-community water systems (NCWS) classified as a surface source shall compile and maintain accurate daily operating records of the water works system on forms (MORs) prepared and furnished by the Department. The daily operating records shall be submitted in a timely manner so they are received by the Department no later than ten days after the end of the reporting month. Any special reports, deemed necessary by the Department to assure continuous satisfactory operation of the water system, shall be submitted to the Department.

   Water systems which desire to use their own forms to report the daily operating results to the Department must have prior approval for the form from the Department.

3. All water works systems must have the equipment necessary to perform all laboratory tests pertinent to the control of the plant or system operation, and the equipment shall be maintained in good working order at all times.

4. Chlorine is the recommended disinfection agent. Other agents will be considered by the Department provided they are effective and testing procedures for their effectiveness are recognized in the latest edition of "Standard Methods for the Examination of Water and Wastewater". All community water systems, using ground water as a raw water source

and serving more than 50 connections or 150 persons shall continuously chlorinate (unless other disinfection methods are approved) and shall maintain a free chlorine residual in all parts of the distribution system in the amount of not less than 0.2 mg/L. Public Water Systems using surface water shall continuously chlorinate and maintain a free chlorine residual of 0.2 mg/L in all parts of the distribution system. The residual disinfectant concentration specified by this rule shall not be less than 0.2 mg/L in more than 5 percent of the samples each month, for any two consecutive months the system serves water to the public.

5. All systems required to submit samples for microbiological examination to the State laboratory must submit said sample in the bottle(s) provided by the Department of Health and sent to the proper state laboratory in the shipping carton provided by the State. The cost of postage for shipping the sample to the proper State laboratory shall be paid by the supplier of water. All samples submitted for bacteriological examination must be collected and mailed to arrive at the proper State laboratory no later than Thursday noon of any week. Thirty hours is the limit allowed from the time of collection to the time of examination at the proper State laboratory. Samples received by the laboratory more than 30 hours after collection are unsatisfactory and will not be analyzed. See Appendix D for the State Laboratories telephone numbers and addresses.

6. Pursuant to the Tennessee Code Annotated Section (T.C.A.) 68-13-711(6) the installation, allowing the installation, or maintenance of any cross-connection, auxiliary intake, or bypass is prohibited unless the source and quality of water from the auxiliary supply, the method of connection, and the use and operation of such cross-connection, auxiliary intake, or bypass has been approved by the Department. The arrangement of sewer, soil, or other drain lines or conduits carrying sewage or other wastes in such a manner that the sewage or waste may find its way into any part of the public water system is prohibited.

   All community water systems (CWS) must adopt an ordinance or policy and plan. After the adoption of the plan, each community water system must establish an ongoing program for the detection and elimination of hazards associated with cross-connections. Records of the cross-connection control program must be maintained by the water supplier and shall include such items as date of inspection, person contacted, recommendations, follow-up, and testing results.

7. Newly constructed or repaired distribution lines, finished water storage facilities and filters shall be flushed and disinfected before use in accordance with methods contained in American Water Works Association (AWWA) Standard C651-92, C652-92, and C653-97 or the latest revision. Bacteriological results indicating adequacy of disinfection procedure on tanks, mains and repairs must be maintained on file for five years.

8. No new construction shall be done nor shall any change be made to any public water system until the engineering plans for the new construction or change have been submitted and approved by the Department. The plans must be submitted 30 days prior to beginning work. Copies of approved plans must be available for inspection at the work site.

9. All vents on wells, springs, storage tanks, overflows and clearwells shall be properly screened. All overflows on springs and tanks shall be screened and protected.

10. All buildings and equipment used in and for the production and distribution of water (to include chemical and other storage buildings) must be well maintained and be reliable and fit for the purpose for which they are used.

11. Before any new or modified community water treatment facility can be placed in service, it must be inspected and approved in writing by the Department.

12. New or modified turbidity removal facilities may not be placed into operation until the facility and the operator have been approved by the Department for the turbidity analysis.

13. All pipe, solder, or flux, which is used in the installation or repair of any public water system, shall be lead free. This shall not apply to lead joints necessary for the repair of cast iron pipes. The term "lead free" in this section is defined as follows:

    (a) When used with respect to solders and flux shall mean solder and flux containing not more than two-tenths of one percent (0.2%) lead and

    (b) When used with respect to pipes and pipe fittings shall mean pipes and pipe fittings containing not more than eight percent (8.0%) lead.

14. The Department may, upon written notice, require confirmation of any sampling results and also may require sampling and analysis for any contaminant when deemed necessary by the Department to protect the public health or welfare.

15. Those public water systems required to monitor for turbidity and chlorine residual must have the laboratory approved by the Department before the results of these analyses can be accepted for compliance purposes.

16. All public water systems using surface water shall provide disinfection to control the biological quality of the water. Due consideration shall be given to the contact time of the disinfectant in the water with relation to pH, ammonia, taste producing substances, temperature, presence and type of pathogens, and trihalomethane formation potential. All disinfection basins must be designed to prevent water short-circuiting the system. The disinfectant will be applied in the manner needed to provide contact time to kill or inactivate any disease causing organisms present.

17. All surface supplied public water systems must filter and disinfect the water. Any ground water system under the direct influence of surface water must meet specific disinfection and treatment standards specified by the state.

SAMPLING AND TESTING FOR CHLORINE RESIDUAL

What is a Free Chlorine Residual? When chlorine is added to water, it first reacts with any organic compounds already in the water and also with any ammonia present. After these reactions are complete, the remaining chlorine is available for disinfecting any bacteria that might exist in the distribution system. This remaining chlorine is called "free chlorine residual". A drop in chlorine residual level in the distribution system is a warning of a potential operating problem and should be investigated and the chlorine residual restored immediately. It may be necessary to increase the chlorine dosage to overcome any contamination present in the water.

Taking a Sample for Chlorine Residual: Chlorine in water is not stable. Therefore, when sampling for a chlorine residual, avoid agitation or excessive exposure to light. The test should be conducted as promptly as possible.

Testing for Chlorine Residual: You need a DPD (N, N, diethyl-p-phenylenediamine) test kit. These can be purchased from a commercial supplier at nominal cost. (See Appendix B for a partial list of kits available).

Use the following steps to perform the DPD test for chlorine residual: (or use manufacturer's instructions)

1. Fill one sample tube with sample water; place it in the holder behind the color comparator.

2. Fill the second tube to the 5 ml mark with the water to be tested (or other level as manufacturer instructs).

3. Add the chemical for free (not total) residual to the second tube and gently swirl to mix.

4. Place tube in comparator.

5. Hold the comparator up to natural light and rotate the color comparator wheel until the wheel color matches the sample color.

6. Read the residual, in mg/L, immediately and record your results as mg/l of free chlorine residual. A free chlorine residual above 0.2 mg/L shall be maintained.

7. Record the results on the monthly operations report and on the bacteriological sampling slip when bacteriological samples are being collected.

RECORDKEEPING

Tennessee Water Supply regulations require that public water systems maintain specific records on its premises or at a location convenient to its premises including the results of its water test, sanitary surveys and other information pertaining to the system.

All water systems must establish permanent files and maintain log books reflecting sampling dates and results. An example of a bacteriological sampling log is present in Appendix I.

Analytical results of chemical analyses must be kept ten years and bacteriological records must be kept on file for five years. These records must show: (1) the date, time, place and by whom the sample was collected; (2) the type of sample, in other words, was it a distribution, repeat sample, raw or finished water or sample collected after repair of old lines or installing new lines; (3) the date of the analysis; (4) the name of laboratory or person doing the analysis and (5) the analytical technique used and the result of the analysis.

Copies of sanitary survey results must be kept for ten years. Turbidity records, daily worksheets and strip charts from water quality monitoring activity must be properly labeled and kept until the next sanitary survey. A sanitary survey is a physical inspection of the water supply system and a review of the operation and maintenance of the system.

Records of actions taken to correct any violation of drinking water standards must be kept for at least three years.

Any such reports required by the state shall be made available for inspection by the public and the state at the appropriate water system office during regular business hours.

REPORTING REQUIREMENTS

All public water systems must report to the Department within 48 hours of the failure to monitor or to meet drinking water maximum contaminant levels or treatment techniques. Immediate notification is required of:

(a) any major breakdown or failure or equipment in the water treatment process occurs which affects the quality or quantity of water leaving the plant;

(b) any serious loss of water service due to a failure of transmission or distribution facilities; or

(c) any situation with the water system which present or may present an eminent or substantial endangerment of health or;

(d) nitrate exceeding the MCL, turbidity in excess of 5 NTU,

(e) fecal coliform or E.coli bacteria are detected in the water system, or

(f) violation of the short-term maximum allowable turbidity limit.

Monthly operation reports are due to the state within 10 days after the end of the month. Copies of any public notices or water system must be sent to the state within 10 days of the completion of the notice.

Systems are not required to report results to the state in those cases where the state laboratory conducts the analyses.

Community and NTNC systems are responsible for insuring that copies of all chemical monitoring results are submitted to the state. When monitoring for special unregulated compounds as directed by the State, a copy of the public notice issued advising customers that the data is available must be submitted within 30 days of receipt of the results

CONSUMER CONFIDENCE REPORT
(Community Water Systems Only)

All community water systems are required to publish a report concerning their water supply and distribute the report to its customers by July 1 of each year. This report must also be sent to the State by July 1 of each year. This report is called the consumer confidence report (CCR). These reports must describe the quality of the water distributed to customers and provide educational information on health effects of various contaminants. The Environmental Protection Agency (EPA) indicates it believes the CCR to be the cornerstone of the public's right to know.

In summary Tennessee's Consumer Confidence Regulation 1200-5-.35 require community water systems to publish by July 1 of each year the following information:

1. The name of the creek, river, aquifer, spring, well or lake from which drinking water is taken;

2. A brief summary of the susceptibility to contamination of the drinking water source;

3. How a customer may obtain a copy of the system's source water assessment;

4. The level or range of levels of any contaminant detected in the drinking water along with the maximum permitted contaminant level and the maximum contaminant level goal;

5. The likely source of the contaminants found in the drinking water;

6. The potential health effects of any contaminant found in drinking water;

7. Any violations if primary standards and the corrective action being taken to remedy the violation;

8. Special educational statements on nitrate, nitrite, lead and arsenic if these contaminants are detected at levels about 50% of the maximum contaminant level;

9. Special educational statements for persons with impaired immune systems, HIV/AIDs and for other persons vulnerable to cryptosporidium;

10. Mechanisms and opportunities for customers to influence the decisions made by the water system that impact the quality of water produced. Dates, times and places of board meetings should be included;

11. Any other violations of the national primary drinking water standards such as reporting, monitoring and recordkeeping; and

12. Telephone numbers of the public water system and the EPA Drinking Water Hotline.

The regulations provide the governor or his designee with the option of allowing systems serving fewer than 10,000 persons to avoid directly mailing the report to each customer provided the report is published in the local newspaper and each customer is advised by mail the report is available on request.

Systems must provide a copy of the report to the state and certify that it was distributed in accordance with the regulations. The EPA indicates the report should be brief and avoid technical jargon. It will permit water systems to add information that does not detract from the intent of the report.

The Division of Water Supply has developed a template to assist community water systems with preparing the consumer confidence report. Water systems may obtain a copy of the template or assistance in the preparation of the CCR from the nearest Division of Water Supply Environmental Assistance Center.

PROTECTING WELLS AND SPRINGS FROM POLLUTION

Groundwater can become contaminated from a variety of pollution sources. Biological and chemical contamination can come from septic tanks, cesspools, leaking underground fuel storage tanks, graveyards, illegal dumping, abandoned wells, landfills, vandalism, contaminated pumps or pipes, feed lots, and surface impoundments. Surface water is certain to contain bacteria and must not be allowed to enter wells.

Measures that you can take to protect your ground water supply include but are not limited to:

1. Limit public access to your spring or well to prevent vandalism.

2. Be sure your well casing extends high enough above ground to prevent surface water from entering the well. The well casing should extend 24 inches above the level of the 100 year flood level of record. There should be a positive sealing of the annulus between

the bore hole and the outside of the well casing to prevent seepage of surface water vertically along the outside pipe into the well. Grouting will provide positive sealing of the annulus between the bore hole and the outside of the well casing. Slabs of concrete poured around the top of a wellhead will also help protect the well. All wells should have a sanitary seal or cap to prevent insects or animals from entering the well. Pitless adapters should be used with submergible pumps. Be sure that your spring has a spring box that is designed to keep out animals, insects and surface water.

3. Don't drill wells or rely on springs near obvious sources of contamination such as septic tanks and field lines.

4. Don't store chemicals dangerous to water supplies near the well or spring. Such chemicals would include fertilizers, pesticides and solvents.

5. Ask your planning or zoning commission to pass zoning or ordinances that regulate or prevent certain land use activities that would contaminate ground water near your well or spring.

6. Don't allow any materials to be dumped into nearby sinkholes.

7. Fence animals away from your wellhead and spring. Cattle should be kept at least 100 feet from the well.

8. Landscape or trench surface water away from wellheads and springs to prevent surface water entry into the well or spring.

9. After making repairs to pipes and pumps, be sure that the pumps or pipes are disinfected before being placed back in use.

10. Don't allow plumbers to use lead solder when repairing and replacing pipes.

11. Properly plug and abandon any abandoned wells on your property and encourage adjacent property owners to do the same. Sinkholes and abandoned wells provide a direct conduit for contaminants into the ground water.

12. Ensure no chemicals are applied within 100 foot (minimum) of the well or spring through written agreements with property owners, if necessary. Other pesticide applications can also be a concern in wellhead protection areas such as from pest control applicators, right-of-way applicators, commercial applicators, etc.

13. Limit the use of onsite septic system to septic waste. Commercially available septic system cleaners containing synthetic organic chemicals (such as 1,1,1-trichloroethane or methylene chloride) have contaminated drinking water wells. Many chemicals should not be disposed of in household septic systems, including oils (e.g., cooking, motor), lawn and garden chemicals, paints and paint thinners, disinfectants, medicines, photographic chemicals, and swimming pool chemicals. Septic systems that are

improperly sited, designed or constructed or maintained can contaminate ground water with bacteria, viruses, nitrates, detergents, oils, and chemicals.

WELLHEAD PROTECTION

The Wellhead Protection Program was established to protect public water systems using ground water from contamination. This program has an emphasis on the prevention of ground water contamination due to the difficulty in cleaning up the contamination once it occurs. These drinking water sources are vulnerable to a variety of contaminant sources such as industrial spills, shallow underground injection discharges (referred to by the EPA as class V (5) wells) through wells, floor drains and septic tanks, leaks from underground storage tanks, etc. Water systems need to be aware of their surroundings and report activities within their wellhead protection areas that may impact their sources of water.

Much of ground water contamination stems from the misuse and improper disposal of liquid and solid wastes; the illegal dumping or abandonment of household, commercial, or industrial chemicals; the accidental spilling of chemicals from trucks, railways, aircraft, handling facilities, and storage tanks; or the improper siting, design, construction, operation, or maintenance of liquid and solid waste disposal facilities. Generally, when the potential sources are used and managed properly, ground water contamination is not likely to occur.

Facilities in wellhead protection areas that store or handle hazardous substances (such as heavy industrial plants, dry cleaners, gas stations, auto repair workshops, and transportation facilities such as trucking, railroad, bus depots and airports) need to be aware of the potential to contaminant water systems and strictly comply with all regulatory requirements. They should also be encouraged to implement best management practices.

Tennessee's Wellhead Protection Program requires the cooperation of state and local government, private industry and the general public. The official designation of wellhead protection areas provides valuable input and emphasis to government agencies in the siting of facilities and the prioritization and cleanup of contamination sites.

DEVELOPING A WELLHEAD PROTECTION PLAN

The wellhead protection program developed in Tennessee is a requirement of the Federal Safe Drinking Water Act and includes <u>all</u> public water systems using a ground water source (wells or springs). This includes everything from churches, restaurants and schools to large water systems such as Memphis. Tennessee has developed regulations with a scaled approach based on the number of individual connections and the average daily production of the system to minimize the burden on small systems.

A "wellhead" is the source area for the water that is withdrawn through a well or spring, similar to the concept of the head of a river. To protect the water supply, it is important to know where the water flowing to that well or spring is coming from. There are more complicated

hydrogeological considerations, but the basic concept is that ground water flows downhill (down-gradient) and the area of protection will be uphill (up-gradient) from the well or spring.

There will be two wellhead protection zones established for each well or spring -- an inner zone (Zone 1) around the well or spring to protect the immediate area from spills, etc., and a larger management zone (Zone 2) to provide for long-term management for the well or spring.

Small systems fall under the size category 1 of the Wellhead Protection Regulations. Category 1 systems include community public water systems with less than 100 connections and less than 20,000 gallons per day (gpd) average daily production and all non-community public water systems. For category 1 systems, both zone 1 and zone 2 are set by regulation as a 250-ft radius for zone 1 and a 750-ft radius for zone 2. The Wellhead Protection Regulations allow for more protective (geologic based) zones to be designated if necessary.

An inventory of potential contaminant sources within the designated zones is required. This involves identifying those facilities and operations within the wellhead protection area which have the potential to impact the ground water flowing to the public supply well or spring. Once the potential contaminant source inventory is completed, the system is required to develop a plan.

For the non-community (churches, schools, etc.) and small community systems the overall development of a wellhead protection plan is designed to be simple. Here is what is required laid out in step-by-step fashion:

1) Obtain a 7 1/2 minute topographic map of your area from the Tennessee Division of Geology (615) 532-1500. If you have difficulty in obtaining a map, contact the Ground Water Management Section within the Division of Water Supply at (615) 532-0191 and they will help you obtain the appropriate map.

2) Locate and mark the water system well(s) and spring(s) on the topographic map. Draw 250 foot radius (Zone 1) and 750 foot radius (Zone 2) (circles of approximately 1/4" and 3/4" diameter, respectively) around each water system well and spring on the map. Make 8 1/2 x 11" photocopies to send to the Division of Water Supply and local government (see below). Be sure that the name of the topographic map is marked somewhere on the copy.

3) A copy of both the letter and the map must be sent to the Division of Water Supply, Ground Water Management Section at the Nashville Central Office. The letter should to state that the water system is developing a wellhead protection program as a regulation requirement under the Tennessee Safe Drinking Water Act for public water systems using ground water. The letter should also request their cooperation/consideration in actions that might affect the well or spring. New systems need to comply within 60 days of the determination that they are a public water system.

4) The system then needs to make a list of the potential ground water threats (contaminant source inventory) that fall within zones 1 and 2. This should include contacting the local fire department/volunteer fire department (if there is one) and asking if they have any Community-Right-to-Know Information regarding chemical use in your area. If you are in a crop production area you should contact the County Natural Resource Conservation Service about chemicals and pesticide use in your wellhead protection area. This

information must be included in the Contaminant Source Inventory. A list of typical potential sources is included later in this section.

5) Take photographs around your wells and springs (compass directions N,NE,E,SE,S,SW,W,NW) and one of the well/wellhouse.

6) Prepare a written Plan on how you will protect your wellhead protection area from potential sources of contamination inventoried previously. The Division is aware you can only control your own property -- concentrate on chemical storage on your property, chemical/pesticide use within Zones 1 and 2 (contact adjacent property owners) and contingency planning (contacts at TEMA and Division of Water Supply).

9) Send in two copies of the Wellhead Protection Plan to the Division of Water Supply, one addressed to the Ground Water Management Section, 401 Church Street, 6th Floor, L&C Tower, Nashville, Tennessee 37243-1549 and the other to the appropriate Water Supply Environmental Assistance Center office. The Plan must include a map with wells and springs labeled and marked Zones 1 and 2, potential contaminant sources list keyed to map, and management plan. New systems have 18 months from the date of determination that they were a public water system to comply.

10) Once the plan has been approved in writing, send a copy to local government officials.

WRITING THE WELLHEAD PROTECTION PLAN

The wellhead protection plan to be submitted to the Division of Water Supply needs to include a map and the contaminant source inventory and needs to state that the system:

1) Will not store chemicals other than those used for drinking water treatment within the wellhouse or adjacent to the well or spring.

2) Will not allow chemicals to be applied adjacent to the well or spring (minimum of 100 feet) and has agreements from adjacent property owners, where appropriate. Has a plan to clean up spills on the property.

3) Has identified the wellhead protection areas to the local planning/zoning commission and county government and asked for them to consider protective measures for these areas in the form of *local ordinances, zoning considerations, etc.*

4) Will actively observe the activities within the designated wellhead protection areas and report pertinent information to the Division of Water Supply and will update the Wellhead Protection Plan every three years by reviewing the wellhead protection areas at least annually for any new potential contaminant sources.

5) Will contact the following agencies in the case of an emergency spill that could impact the water source within the Wellhead Protection Area:

Tennessee Emergency Management Agency (TEMA)
at 1-800-262-3300
within 24 hours

Tennessee Division of Water Supply
at (615) 532-0191
within 72 hours

6) Will notify customers to discontinue use in the event of contamination and notify the appropriate Division of Water Supply Environmental Assistance Center.

As a part of the required contingency planning, the system needs to give an estimate of the quantity of water currently used and estimate the maximum quantity of water the system is capable of producing. It also needs to address the most likely remedy for more water demand (drill an additional well, hook up to another water system, etc.) in both the short term and the long term and what will be done in the case of a complete shutdown due to contamination (haul in water; bottled water; additional treatment, where appropriate; etc.).

DEVELOPING WELLHEAD PROTECTION MANAGEMENT STRATEGIES

Public water systems have limited tools at their disposal in protecting their water supply. For this reason, the Wellhead Protection Regulations require the notification of local government (county government as well as municipal government where appropriate) and a request for support. For the small water systems this is intended to raise the awareness of local government to the small water system. It is not anticipated that local government will provide much assistance to small systems beyond keeping a record of the systems within the area. There are however steps you can take to protect your water supply and to assist the Division of Water Supply in that protection. The Division of Water Supply will also work with other state agencies with ground water regulatory roles to keep them informed of all public water systems across the state using ground water.

GROUND WATER UNDER THE DIRECT INFLUENCE OF SURFACE WATER

Ground water under the direct influence of surface water is defined as any water under the surface of the ground with (a) significant occurrence of insects or other microorganisms, algae, or large diameter pathogens; or (b) significant and relative rapid shifts in water characteristics such as turbidity, temperature, conductivity or pH which closely correlate to climatological or surface water conditions.

The traditional concept that all water in subsurface aquifers is free from pathogenic organisms is based upon the belief that soil is an effective filtering agent that removes microorganisms as well as other particles from ground water. An aquifer is a water bearing stratum of rock, sand, or gravel. Some underground water may not have experienced filtration by soil. It may have entered the well or spring directly from the surface through a sinkhole, abandoned well or solution channel between rocks and will contain bacteria and other disease causing organisms.

Ground water under the direct influence of surface water is subject to the surface water treatment rules (SWTR). The surface water treatment rules require in most cases that the raw water source be filtered and disinfected. Operators of community water systems were required to determine whether or not their wells or springs are under the direct influence of surface water by June 29,

1994. Operators of non-community water systems using ground water as a raw water source were required to determine if their wells or springs are under the direct influence of surface water by June 29, 1999. Public water systems must make the determination of direct surface water influence on all new ground water sources before they can be used. The determination must be made available to the state. Guidance on how to determine direct surface water influence is available from the State.

Wells west of the western valley of the Tennessee River that produce water from depths greater than 50 feet and located in areas underlain by unconsolidated sand and gravel will be defined as not being under the direct influence of surface water and not subject to the surface water treatment rules. It is the responsibility of each water system operator or owner that has a well meeting this criteria to declare in writing to the Department that its ground water system meets the requirements for this exemption. A summary of the indicators of a ground water source under the direct influence of surface water follows:

Indicators of Ground Water Under the Direct Influence of Surface Water

Biological

The presence of Giardia lamblia, Dip hilobothrium, Cryptosporidium, algae, rotifers, coccidia, insect parts, diatoms, insects, or chironomids or other living microorganisms.

Temperature

Daily or seasonal temperature fluctuations of 4 degrees centigrade during the course of a year.

Chemical Parameters

Rapid fluctuations in pH, conductivity, hardness or other chemical parameters.

Turbidity

Turbidity of the raw water exceeding 5 NTU. Turbidity fluctuations greater than 1 NTU over the course of a year may also be indicative of surface water influence. Water with a turbidity over 5 NTU will likely appear dingy.

Other Indicators of Surface Water Influence

(1) Wells that produce water from depths less than 50 feet.

(2) Well located in an unconfined aquifer and located within 200 feet of a surface body of water where the static level of water in a well is equal to or less than the static level of water in the surface body of water.

(3) Wells with casings cut off below ground level.

(4) Springs with faulty spring boxes.

(5) Wells that are not properly grouted or backfilled.

(6) Wells or springs near sinkholes or in areas underlain by dolomite or limestone rock.

(7) Wells without sanitary seals.

(8) Customer complaints regarding water quality or outbreaks or water related illnesses.

(9) Wells or springs that become muddy after a rain.

(10) Wells or springs with yields that arise or fall rapidly after a rain.

Appendix A

LABORATORIES CERTIFIED FOR DRINKING WATER ANALYSES

The Division of Water Supply maintains a list of laboratories located in Tennessee that have been certified by the State for analysis of water samples for various contaminants. An updated copy of the certified laboratory list can be obtained by calling the Environmental Assistance Center at 1-888-891-8332 and asking to speak to someone in the Division of Water Supply or by visiting the Division's web site. Be sure to check with your laboratory to ensure that the laboratory has certification for the contaminant for which you need analysis. Be sure to ask the laboratory you chose if they are currently certified by the State of Tennessee to perform the analysis you desire.

Appendix B

TURBIDIMETERS

If you are required to measure turbidity of water, you must use an instrument that uses the nephelometric method for measuring turbidity. The state does not recommend nor endorse any particular unit, manufacturer, or supplier. It only requires that the instrument and method comply with both state and federal laboratory methodogly. Listed below is a partial list on turbidimeters that are acceptable. This is only a partial list and other instruments may be available now or in the future. You can also check the following Web site for further information: http://www.wateronline.com/buyersguide/ and look for turbidimeters.

Turbidimeter Model	**Supplier**
Hach 2100N Hach 2100AN Hach 2100P	Hach Chemical Co. P. O. Box 389 Loveland, CO 80537 Phone: (800) 227-4224 or Rock City Machine Co. 307 3rd Avenue South Nashville, TN 37201 Phone: (615) 244-1371
2020	LaMotte Company P.O. Box 329 802 Washington Ave. Chestertown, MD 21620

	Phone: (800) 344-3100
Orbeco-Hellige Model 966 Orbeco-Hellige Model 965-10A	Orbeco Analytical Systems, Inc. 185 Marine Street Farmington, NY 11735 Phone: (800) 922-5242
C 102 C 114	Hanna Instruments, Inc. Highland Industrial Park 584 Park East Dr. Woonsocket, RI 02895 Phone: (800) HANNAUS
800	VWR Scientific 1310 Goshen Parkway West Chester, PA 19380 Phone: (800) 932-5000
CHEMetrics I-4300	CHEMetrics, Inc. Route 28 Calverton, VA 20138 Phone (800) 356-3072

CHLORINE RESIDUAL TEST KITS

This is a partial list of chlorine residual test kits that use the DPD (diethyl-p-phenylenediamine) method. The state does not recommend nor endorse any particular unit, manufacturer, or supplier. It only requires that the instrument and method comply with both state and federal laboratory methodogly. This is only a partial list and other instruments may be available now or in the future.

Chlorine Test Kit	**Supplier**
Bio-Gard Multi 1200-V	San Juan Pools, Inc. 200 South Taft Street Lakewood, CO 80228
Hach Model CN-66	Hach Chemical Co. P. O. Box 389 Loveland, CO 80537
Hellige Model 605-HT + 430-D Disc	Any Major Supplier

LaMotte Model 6819/LP-MW	LaMotte Chemical Products Co. Box 329 Chestertown, MD 21620
Taylor Model 1259 1516 1517	Taylor Chemicals, Inc. 7300 York Road Baltimore, MD 21204
Lovibond AF 112B	The Tintometer Co. Busch Corporate Center 206 Packets Court-Suite B Williamsburg, VA 23185

Appendix C

PREPARATION AND FEED RATES OF CHLORINE SOLUTIONS

1. Using Calcium Hypochlorite (Trade name: HTH)

   A. Equipment needed: Two large plastic garbage type containers, plastic hose, and a positive displacement pump.

   B. Preparation of the solution. Using one of the plastic garbage type containers as a mixing container, prepare a solution containing ½% chlorine solution, as follows:

      (1) Most HTH now available has 65% available chlorine. Check the packaging container for the chlorine concentration. We will use 65% in this example.

      (2) Our plastic garbage containers are 30-gallon size. We will mix 30 gallons of solution.

      (3) One gallon of water weights 8.34 pounds (lbs.)

      (4) Thirty (30) gallons of water @ 8.34 lbs/gallon = 250.2 lbs.

      (5) A ½% solution of chlorine in 30 gallons = (½% x 250.2 lbs). = 1.25 lbs. of chlorine.

      (6) Since HTH is only 65% available chlorine, divide 1.25 by 0.65 = 1.92 lb. Carefully mix 1.92 lbs of HTH in 30 gallons of water.

   C. Calculation of feed rate.

      (1) You decide to feed 2 parts per million (ppm) of chlorine into the water system.

      (2) The ½% solution is the same as 5,000 parts per million.

      (3) The water system pump has a capability of pumping 25 gallons per minute.

      (4) The positive displacement pump has a range of $1/1000^{th}$ gallon/minute to $5/100^{th}$ gallon per minute.

      (5) You set up the following proportion:

$$\frac{\text{Feed rate of ½\% solution/min}}{25 \text{ gallons/min}} = \frac{2}{5{,}000}$$

or Feed rate = $\frac{2 \times 25}{5{,}000}$ = .01 gallons/min.

2. Using Sodium Hypochlorite (Household or Commercial Bleach), NSF approved. Do not use scented bleaches.

   A. Equipment needed: Since this chemical comes in liquid form, only one plastic container is needed.

   B. Preparation of a dilute solution. If you use household bleach, it usually contains about 5% available chlorine. However, many of the newer bleaches contained 6.25%. (Check the label to be sure). Commercial bleach comes in concentrations from 9 to 15% available chlorine. For this example, let's assume the bleach you have obtained has 5% available chlorine. You decide to prepare a 1/10% solution to feed to your water system.

      (1) You decide to prepare 30 gallons of dilute solutions.

      (2) Available chlorine in each gallon of your bleach is 5%.

      (3) Amount of chlorine (in gallons) needed for a 1/10% solution is 1/10% x 30 gallons = .001 x 30 gallons = .03 gallons.

      (4) Amount of 5% bleach needed in a 30 gallon mixture is $\frac{.03}{.05}$ = 0.60 gallons.*

      (*Note: This calculation is not exact, but is sufficiently accurate for this purpose).

      (5) Mixing 30 gallons of water with 0.6 gallons of 5% bleach yields a 1/10% solution of chlorine.

   C. Calculation for feed rate.

      (1) You again have decided to feed 2 parts per million and the water system pump has a capability of pumping 25 gallons per minute.

      (2) 1/10% solution is the same as 1000 parts/million.

      (3) Set up the following proportion:

$$\frac{\text{Feed rate of 1/10\% solution/minute}}{25 \text{ gallons/minute}} = \frac{2 \text{ ppm}}{1000 \text{ ppm}}$$

$$\text{Feed rate} = \frac{2 \times 25}{1000} = \frac{50}{1000} = 0.05 \text{ gal/min/}$$

Appendix D

TENNESSEE WATER SUPPLY STAFF

Central Office 401 Church Street 6th Floor, L & C Tower Nashville, Tennessee 37243-1549 Director – W. David Draughon, Jr. (615) 532-0152 Deputy Director – Robert Foster (615) 532-0155 Reports/Data Jeff Bagwell – (615) 532-0183 Leesa Head - (615) 532-0182 Craig LaFever – (615)-532-1081 Engineering Bill Hench – (615)-532-1065	**Cookeville Environmental Assistance Center** 1221 South Willow Avenue Cookeville, Tennessee 38506 Field Office Manager – Mike Hale (931) 432-4015 **Nashville Environmental Assistance Center** 711 R.S. Gass Blvd. Nashville, Tennessee 37243 Field Office Manager – Louis K. Burnett (615) 687-7031
Environmental Assistance Centers 1-888-891-8332	**Jackson Environmental Assistance Center** 362 Carriage House Drive Jackson, Tennessee 38305 Field Office Manager – Ed O'Neill (731) 512-1338
Chattanooga Environmental Assistance Center 540 McCallie Avenue, Suite 550 Chattanooga, Tennessee 37402-2013 Field Office Manager – Gary Burris (423) 634-5736	**Johnson City Environmental Assistance Center** 2305 Silverdale Road Johnson City, Tennessee 37601 Field Office Manager – Gay Irwin (423) 854-5467
Columbia Environmental Assistance Center 2484 Park Plus Drive Columbia, Tennessee 38401 Field Office Manager – David Money (931) 840-4172	**Knoxville Environmental Assistance Center** 2700 Middlebrook Pike Suite 220 Knoxville, Tennessee 37921 Field Office Manager – Steve Roberts (865) 594-5515

Fleming Training Center (FTC) 2022 Blanton Drive Murfreesboro, Tennessee 37129 (615) 898-8090	**Middle Tennessee Laboratory Services** Laboratory – Cindy Graves, Nashville Central Laboratory, R.S. Gass Building 630 Ben Allen Road, Nashville, TN 37219-5402 (615) 262-6371
West Tennessee Laboratory Services Laboratory Jackson Branch Lab P. O. Box 849, Jackson, TN 38301 (731) 424-9200, Ext. 364 or 365	**East and Southeast Tennessee Laboratory Services** Laboratory – Dr. Phil Baker, Knoxville Branch Lab, 1522 Cherokee Trail Knoxville, TN 37920 (865) 549-5209

Appendix E

Well Disinfection Using Ordinary Laundry Bleach

The procedure for cleaning and disinfecting a well or spring is often called "shock chlorination". It can be accomplished using ordinary household laundry bleach. Do not use scented bleaches. Laundry bleach contains about 5.25 percent sodium hypochlorite (a form of chlorine). Chlorine is used to treat municipal water supplies and is very effective in killing bacteria and certain viruses.

The term "shock chlorination" is very descriptive, since concentrations of chlorine ranging from 50 to 200 milligrams per liter are used in the procedure. This is 100 to 400 times the amount of chlorine used in treated municipal water supplies. While municipal water supplies always have low levels of chlorine present to kill bacteria, the shock chlorination procedure is used to disinfect private water supplies (wells or springs) on an "as needed" basis. Once the "shocking" period (12 to 24 hours) is over, all of the highly chlorinated water is flushed from the plumbing system. You must make sure the chlorinated water does not reach a stream as it will kill fish and aquatic life. Household water use should be kept to an absolute minimum during the shock chlorination procedure. If the source is true ground water, shock chlorination is effective where the source has been contaminated by repairs to the well or pump, area flooding, etc. It is not an effective treatment to a source that is continually subject to contamination including a ground water source that is under the direct influence of surface water.

Shock chlorination can also be effective in reducing iron bacteria. Iron bacteria are naturally occurring and do not cause disease; but do form a reddish brown slime that coats the inside of pipes and plumbing fixtures. Iron bacteria may clog watering devices that have small openings and reduce performance in pumps. Iron bacteria should not be confused with iron dissolved in water. Dissolved iron causes red stains on clothing and plumbing fixtures and is affected very little by shock chlorination.

The amount of water in a well (or spring) determines the amount of chlorine solution needed for proper disinfection. Table 1, "Amount of Laundry Bleach Needed for Shock Chlorination" lists proper amounts of ordinary laundry bleach to use in applying the shock chlorination procedure. **Remember, Table 1 is for the depth of standing water in the well**. To find the depth of water in your well, subtract the distance to the top of the water in the well from the well depth.

EXAMPLE:	A well has a 6 inch casing diameter is 100 feet deep and has 50 feet of standing water. Find the amount of laundry bleach required to disinfect the well.
SOLUTION:	In Table 1, find the column for a 6 inch well and the row for 50 feet of standing water. We see that Table 1 indicates that one quart of laundry bleach will supply the EPA recommended concentration of 100 mg/liter of available chlorine.

Table 1. Amount of Laundry Bleach (About 5.25% Sodium Hypochlorite)* Needed for Shock Chlorination.

	Casing Diameter				
Height of Water in Well (feet)	4 inch	6 inch	8 inch	10 inch	12 inch
10	½ cup	1 cup	1½ cup	1 pint	2 pints
25	1 cup	1 pint	2 pints	3 pints	4½ pints
50	1 pint	1 quart	2 quarts	3 quarts	1 gallon
100	1 quart	2 quarts	1-gallon	1½ gallon	2 gallons
150	3 pints	3 quarts	1½ gallon	2 gallons	3 gallons

* Addition of this amount of laundry bleach (5.25% sodium Hypochlorite) will provide the USEPA recommended concentration of 100 milligrams per liter of available chlorine.

If the depth of water in your well exceeds 150 feet, then use the following simple formula to determine the correct amount of laundry bleach to use for a well with a 6-inch casing. (This formula is valid for 6-inch casings only. If your well casing is larger or smaller than 6 inches, use formulas provided in Table 2, "Volume of Water Per Linear Foot for Various Well Diameters" under Shock Chlorination Procedure to calculate the proper amount of laundry bleach for disinfection.)

Formula A (6 inch well): 0.374 x [Depth of Water in the Well] =ounces.

Remember there are 8 ounces in a cup, 32 ounces in a quart and 128 ounces in a gallon.

EXAMPLE: A well with a 6 inch casing is 452 feet deep and has 347 feet of standing water. Find the amount of laundry bleach to use for proper shock chlorination.

SOLUTION: 0.374 x [347 feet of standing water] = 129.7 ounces. Now 129.7 ounces is equal to approximately 1 gallon, therefore, you would use one gallon of laundry bleach to disinfect this well.

Most water treatment equipment such as water softeners, iron filters and sand filters, should also be shock chlorinated. Check the manufacturers' literature before chlorination treatment of equipment and pressure tanks to determine the applicability of shock chlorination to that system. Administrating shock chlorination against the manufacturer's recommendations may void your warranty.

BEFORE YOU BEGIN

Do not chlorinate activated carbon or charcoal filters. These filters will absorb the chlorine, greatly reducing the life of the filter. If an activated carbon filter system is in place, turn the

selector valve to "Bypass" position to route the highly chlorinated water away from the filter. Turn the selector valve on "On" when system is flushed.

Be careful when handling concentrated chlorine solutions. Wear rubber gloves, goggles, and a protective apron when handling chlorine solutions. If the chlorine solution accidentally gets on your skin, flush immediately with clean water.

Never mix chlorine solutions with other cleaning agents, especially ammonia, because toxic gases may be formed.

Do not use "Fresh Scent" bleach or other special laundry products to disinfect wells. Use inexpensive "plain" laundry bleach with a 5.25% sodium hypochlorite content for disinfecting wells (or springs). Use NSF approved bleach.

SHOCK CHLORINATION PROCEDURE

1. Obtain and store enough clean drinking water to supply your water demand for at least 24 hours.

2. From Table 1, "Amount of Laundry Bleach (About 5.25% Sodium Hypochlorite)* Needed for Shock Chlorination", or using Formula A (previous page), determine the proper amount of laundry bleach to disinfect the well. Mix the chlorine and water in a large container (5 gallons) and pour the solution directly into the well.

3. Turn on the outdoor faucet nearest the well and let water run until a strong odor of chlorine is detected. If strong odor is not detected, add more chlorine bleach directly into the well.

4. Turn the faucet off. Connect a garden hose to the outdoor faucet and the hose to the well.

5. Attach a spray nozzle to the end of the hose and turn the faucet back on. Thoroughly wash down the entire inside surface of the well casing with the sprayer nozzle for at least 10 minutes. You will be recycling water from the well back into the well.

6. After thoroughly washing down and disinfecting the well casing with the garden hose, turn on the remaining outdoor and indoor faucets until a strong chlorine odor is detected at each location. (This ensures that the bacteria killing chlorine solution is in all of the plumbing associated with the well).

7. Let the chlorinated water stand in the water system pipes for at least 12 to 24 hours. Do not drink the water from your well during this period. You may flush the toilets, but try to minimize the number of flushes. Place reminder ribbons on all indoor and outdoor faucets and caution guests that they should use the stored water for drinking purposes.

8. After the chlorinated water had remained in the pipes for 12 to 24 hours, completely flush the system of all remaining chlorine by turning on all of the outside faucets and letting

them run until the chlorine smell dissipates. Do not turn on any of the indoor faucets until the strong chlorine smell has dissipated from the outdoor faucets. This will prevent undue loading on the septic tank system, which can be damaged by the high chlorine concentration. Do not allow the chlorinated water to reach a stream, river, or creek. Chlorine will kill fish and aquatic life.

9. Finally, turn on indoor faucets and let run until the chlorine smell dissipates. The water system is now completely flushed and ready for normal usage. A residual chlorine odor and taste may persist in your water for a few days.

Wait 1 to 2 weeks and have the well water tested again for coliform bacteria. If coliform bacteria are still present after administering the shock chlorination procedure, then a continuous disinfection system will be necessary.

Formulas for Calculating Proper Amount of Laundry Bleach for Shock Chlorination

Table 2. Volume of Water Per Linear Foot for Various Well Diameters.

Diameter (inches)	Volume (gal/ft)	Diameter (inches)	Volume (gal/ft)	Diameter (inches)	Volume (gal/ft)
4	0.65	15	9.18	27	29.74
6	1.47	16	10.44	30	36.72
8	2.61	18	13.22	36	52.88
10	4.08	20	16.32	42	71.97
12	5.88	22	19.75	48	94.00
14	8.00	24	23.50	60	148.88

PROCEDURE: Find the volume of water per linear foot for the well casing diameter in question. Place that value in Formula B.

Formula B (Height of water in well (feet)x(Volume(gal/ft) from Table 2)= gallons

To compute the number of fluid ounces of laundry bleach required to achieve the desired chlorine concentration take the answer from Formula B and place it in Formula C.

Formula C (Height of water in well (feet)x(Volume(gal/ft) from Table 1) = ounces

EXAMPLE: An individual has a well with a 6" casing diameter. The well is 300 feet deep and has 50 feet of standing water. Find the number of ounces required to treat the well.

SOLUTION: First find the volume of water per linear foot from Table 2. The well has a 6" diameter casing so Table gives a value of 1.47 gal/ft. Now place this number (1.47) in Formula B as shown below:

Formula B {1.47 (gal/ft)}x{50(ft) of water} = 73.5 gallons
Now place this answer (73.5) in Formula C as shown below:
Formula C {73.5 gallons}x{0.2544 ounces/gallon} = 18.70 ounces
Use 18.70 ounces (1/2 quart) for proper disinfection.

Appendix F

GUIDANCE FOR THE PREPARATION OF SAMPLE SITE PLANS

AND OTHER CONSIDERATIONS OF FOR COLIFORM MONITORING

SITTING PLAN REQUIREMENTS

1. The plan must be made available for review during sanitary surveys. The plan must be in writing and kept on-site at the water system. Don't mail the plan to the state unless you are specifically requested to do so. The plan should be simple. It should be easily understood by the persons taking the bacteriological sample and by the person conducting the sanitary survey.

2. The objective of the plan should be to insure that bacteriological samples are collected at sites which are representative of water throughout the distribution system including dead end lines, low use areas, residential areas and areas near large storage tanks. The sample plan should insure that no portion of the distribution system is neglected during the course of a year. For example; the distribution system could be divided into sectors and bacteriological samples chosen from a variety of sample points in each sector. Sampling site locations should be justifiable from the standpoint that it helps the water purveyor understand the bacteriological quality of the water through the system and describes water quality consumed by all of the system's customers. The plan should identify the number of persons served by the system. The plan should include the total coliform standard in order that persons using the plan can readily determine if a violation has occurred. The plan should provide that the bacteriological samples are collected from a free flowing outlet of the ultimate user of the public water system.

3. The plan should provide for community water systems to collect at least 30% of the samples from residential areas. For the purposes of the plan residential areas are defined as locations in the distribution system served by the smallest distribution lines.

4. The plan must include maps of the distribution system, which would allow the sanitary surveyor to determine if samples were collected at dead ends, low use areas, near storage tanks or other high probability areas for coliform. The map should reflect the size of the main serving the service tap where the sample was taken. The designation of sampling zones rather than specific taps will be approved. A single layout plan sheet, provided the size of the system allows it that shows lines sizes in color codes is preferred.

5. The plan should provide for fecal determinations on all coliform positive samples.

a. For systems using the state laboratory, the state will automatically run fecal coliform on total coliform positive samples.

b. For systems having laboratories with certification for total coliform determinations but no certification for fecal, the plan should explain how, when and where total coliforms positive samples will be examined for fecal coliform.

c. For systems having laboratories with certification for both total and fecal coliform, the plan should include copies of correspondence from the state granting certification.

6. The plan should specify how, when and where routine and repeat samples should be collected. The plan should specify the number of routine and repeat samples that must be collected. The plan should state that bacteriological samples must be collected throughout the month. The plan should provide for samples to be collected throughout the month. Generally, one third of the samples should be collected each week for the first three weeks of the month.

a. For systems using the state laboratory four repeat samples will be collected within twenty-four hours of being notified of a total coliform positive. One sample must be collected at the original positive, one sample within five-service connections upstream of the positive sample location, one sample within five-service connections downstream of the positive sample location, and a fourth sample at any of these locations. All repeat samples must be collected on the same day. The plan should provide the collection and analysis of repeat samples on weekends or holidays following any fecal or E-coli routine or repeat positive samples, or as an alternative provide for a boil water notice to be issued until sufficient samples can be collected and analyzed to verify that any contamination has been eliminated.

b. The plan should provide that any system collecting fewer than five samples per month must collect a minimum of five samples the month following any month with a positive total coliform sample.

<u>OTHER SUGGESTIONS THAT THE SYSTEM MAY INCLUDE IN THE PLAN</u>

1. The plan should include the language to be used when public notification is necessary and the time frames for completing the public notification process.

It is suggested that the water system preplan how it will explain such things as the corrective action taken to eliminate the coliform violations, where in the distribution system the positive samples occurred and how long they persisted. Large systems may want to consider publishing a small map showing where the positive sample was found in relation to where negative samples were found during the same time period.

2. The plan should identify the person or persons responsible for reporting to the state and the time frames allowed by regulation for each report.

    a. Any E. coli or fecal coliform positive must be reported to the state by the end of the business day the positive was discovered.

    b. A public water system that exceeds the MCL for total coliform must report the violation to the state no later than the end of the next business day.

    c. Failure to comply with coliform monitoring requirements must be reported as a monitoring violation to the state within the ten days after the system discovers the violation and also the public must be notified of the violation.

3. The plan should include clear instructions on mechanisms available to properly collect coliform samples.

4. The plan should explain repeat sampling procedures for systems having only on tap or when the original samples were taken on a dead-end tap.

5. The plan should explain repeat sampling procedures for systems having only on tap or when the original samples were taken on a dead-end tap.

Appendix G

DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY

WELLHEAD PROTECTION CHECKLIST
FOR SMALL COMMUNITY & NONCOMMUNITY SUPPLIES

Complete all parts of this checklist. Enter "N/A" if an answer is unknown or if an item is not applicable.

General Information

1. Small Water System or Church Name: _____

2. System or Church Mailing Address: _____
_____
_____

3. PWSID#: _____ 4. Phone: (____) _____

5. Primary Contact: _____
(person responsible for water quality)

6. Directions to your location: _____
_____
_____

Well or Spring Information

7. Number of wells or springs: _____ 8. Approximate year drilled: _____

9. Driller's name: _____ 10. Depth of each well: _____

11. Number of people served by wells or springs: _____

12. Estimate the amount of water used each month: _____

13. How is the water used? _____

14. Topographic quadrangle map name: _____

15. Are well logs available for the wells? YES _____ NO _____
If yes, include a copy(ies) as part of this report.

16. Is the well inside a wellhouse? YES _____ NO _____

17. Are any chemicals or gasoline stored inside the wellhouse? YES _____ NO _____

If yes, list all which apply: _____

18. Is fertilizer or weedkiller used in the vicinity of the wells? YES _____ NO _____
If yes, list all which apply: _____

19. Estimate the distance from the septic tanks (or field lines) to the water wells (or springs): _____

20. Is the area immediately around the well prone to flooding? YES _____ NO _____

21. Are there any abandoned wells on the property? YES _____ NO _____

If yes, indicate the present condition (sealed, capped, etc.): _____

Wellhead Protection Zones

22. How were Zone 1 (250 ft. radius) and Zone 2 (750 ft. radius) measured (tape, pacing, other)? _____

_____

23. Are septic tanks buried in the vicinity of the well/spring? YES _____ NO _____
If yes, indicate the following:
Number of tanks: _____
Age of tanks: _____
Distance to nearest well/spring: _____

24. Is heating oil, engine oil or gasoline stored within Zones 1 and 2? YES _____ NO _____
If yes, is there evidence of leaking tanks? YES _____ NO _____

25. What was the land used for before the establishment of the system/church? _____

_____

26. Are there environmental concerns in the area? YES _____ NO _____
If yes, describe: _____

27. How are the grounds maintained (mowed, other)? _____

28. Are pesticides used within the wellhead protection zone? YES _____ NO _____
If yes, are they stored within the zone? _____

29. Has water quality testing shown any positive bacterial results or chemical detections? YES ___ NO ___
If yes, describe: _____

30. What is the nearest surface water to the well(s) or spring(s)? _____

31. In which direction does surface water run-off flow from the well site(s)? _____

32. Does the well/spring water get cloudy or muddy after heavy rains? YES _____ NO _____

Potential Contaminant Source Inventory

33. **Land use within Zones 1 and 2**

Agricultural (crop or livestock): _____

Animal Waste Lagoons/Barns: _____

Industrial/Commercial Operations (gas stations/mechanics, manufacturing facilities, paint shops, machine shops, salvage yards, etc.): _____

Is there a cemetery on the property? YES _____ NO _____
If yes, how far is the cemetery from the well(s) or spring(s)? _____

Landfills/Dumps: _____

Other: _____

34. **Geologic Settings**

Sinkholes: _____

Disappearing Streams: _____

35. **Transportation**

Major Highway(s), Railroad(s) or Airport(s): _____

Contingency Planning

Enter agency name and phone number:

36. _____ County Civil Defense Phone: (_____) _____

37. _____ County Health Department Phone: (_____) _____

38. Tennessee Emergency Management Agency (TEMA) Phone: (_____) _____

39. Name of other agency: _____ Phone: (_____) _____

Sketch and Photographs of Wells/Springs

40. Include a detailed sketch of the area. (Example is attached.)

41. Regulations require one (1) photograph be taken of the well or spring and eight (8) photographs be taken of the area around each well or spring. Use a magnetic compass to determine the 8 directions around the well/spring (i.e., N, NE, E, etc.). Pictures should show the well/spring in the foreground (bottom of the picture) with the focus on what is behind and beyond the well/spring. Use the attached template for the photographs.

If you have questions concerning this checklist, contact the Division of Water Supply at (615) 532-0191 or

1-800-523-4873.

UPON COMPLETION OF THIS FORM:

1. Submit the original with the original photographs to:

   Division of Water Supply
   6th Floor, L & C Tower
   401 Church Street
   Nashville, TN 37243-1549

2. Submit a copy to the appropriate Environmental Field Office.

3. Maintain a copy for your records.

CN-1083 RDA 2474

Appendix H

TERMS

AWWA	American Water Works Association
CCR	Consumer Confidence Report
CWS	Community Water System
D	Routine sample
Department	Tennessee Department of Environment and Conservation
DPD	N, N, Dipthyl-p phenylenediamine
DWS	Division of Water Supply
EAC	Environmental Assistance Center
EPA	United States Environmental Protection Agency
FTC	Fleming Training Center
GWUDI	Ground Water Under the Direct Influence
gpd	gallons per day
gpm	gallons per minute
HTH	Trade name for Calcium Hypochlorite
lbs	pounds
MCL	Maximum Contaminant Level
mg/L	milligrams per liter (a ppm is considered the same as mg/L)
ml	milliliter
MOR	Monthly Operation Report
MT	Military Time
N	New line sample
NCWS	Non-community Water System
NPDWR	National Primary Drinking Water Regulations
NSF	National Sanitation Foundation
NTNCWS	Non-transient Non-community Water System
NTU	Nephelometric Turbidity Unit
pCi/L	picocuries per liter
ppm	parts per million
PWS	Public Water System
PWSID	Public Water System Identification Number
Q	Quality control sample
R	Repeat sample
S	Special sample
SWTR	Surface Water Treatment Rule
T.C.A.	Tennessee Code Annotated (State Law)
TDEC	Tennessee Department of Environment and Conservation
TDS	Total Dissolve Solids
TEMA	Tennessee Emergency Management Agency
TNCWS	Transient Non-community Water System
TT	Treatment Technique

Appendix I

Bacteriological Sample Log

Date Sample Taken MM/DD/YY	Time Sample Taken (Military time)	Sample Location (Describe, i.e. Cedar Lodge Kitchen Sink)	Date Sample Mailed MM/DD/YY	Date Sample Results Reviewed	Sample Results Positive (+) Negative (-)	If Sample * Results +, Repeat Samples Taken (Yes=Y)	Date Public Notice Given

Military Time

8:30 a.m. is 0830 in MT (essentially clock time)
1:30 p.m. is 1330 in MT (clock time plus 12)

*Show Date, Time, Place, and provide for Results of each repeat sample taken on this log.